The Chemical Age

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Notes and Comments

Bottles for Laboratory Chemicals

THE importance of storing certain chemicals and other merchandise in containers which exclude even diffused daylight, or only certain wavelengths of light, is being increasingly appreciated. In the United States, a green transparent wrapper has been developed for the purpose of keeping potato chips free from rancidity, even though the packages are exposed to strong light. Other foodstuffs, particularly those rich in fats which tend to become rancid, are also protected by darkness, and wastage is thereby prevented. The chemical manufacturer has for long used amber-coloured glass bottles, whilst the pharmacist in serving the public has made good use of blue bottles to distinguish certain liquids, such as lotions, which are " not to be taken " internally. Bottle design, however, has gone much further than that, so far as the packing of chemicals is concerned. Certain makes of laboratory chemicals are now packed in amber-coloured glass bottles, which are provided with specially designed non-metallic screw caps. The new caps are quite serviceable and were introduced to overcome the corrosion which results from unfavourable atmospheric conditions in the laboratory storeroom, and from acid vapours which are constantly present in the laboratory whatever precautions are observed. Large facets are provided around the side of these caps to make it an easy matter to open the bottles, and the cap extends over the lip of the bottle to avoid that accumulation of dust which is so noticeable in the case of cork-stoppered bottles. In addition, a special liner, which is impervious to the chemical in question, ensures airtight sealing when the handy screw cap is replaced. The amber-coloured glass, of course, affords the maximum protection against light as a deteriorating agent.

A Novel Repair Problem

NEW uses for the oxy-acetylene welding process continue to be developed and yet only a proportion of the industries which are concerned hear of them without delay. Nearly every chemical works is now acquainted with ordinary welding and cutting practice. The idea that the blowpipe should be used to repair broken machine parts is also well established, and other works apply the welding process to the rebuilding of worn parts and for the assembling of pipework. Listen, one moment, to the tale of a new application. Acid fumes, as we all know, are liable to play havoc with the stems of the valves on steam pipes which serve chemical or chemical-using plant. In certain exceptional cases the action may be so energetic that it becomes necessary to replace the valve stems every two or three weeks. A particular instance of this occurs where acid is used in metal pickling operations at engineering works, valves being located on the steam pipes which lead to the scrubbers where pickling acid is removed from the treated metal parts. Nitrided steel has already proved to be one of the most suitable metals for the stems of these valves, but the uncovered portion of the stem is exposed to very severe corrosive conditions in the acid-laden spray which arises in the scrubber. Quite recently, however, it has been found practicable to rebuild these worn valve stems with Monel metal, applied by the oxy-acetylene process in a manner similar to that adopted in rebuilding a worn surface with bronze. Monel metal appeared to be the only metal which was capable of resisting the acid spray in question, and it was certainly useful to find that it could be applied in the manner mentioned.

Light Week-End Reading

A CONTRIBUTOR to the " Yorkshire Post," who signs himself " Northerner," has been investigating some of the hidden mysteries of the Huddersfield Technical College library, as a result of which he gave last Saturday particulars of a few books which, he suggested, would provide a little light reading for the week-end. He unhesitatingly recommended some "thrillers" by members of the college " which deserves to be better known as a home of good literature." He proceeds: " Here is a delightful little volume that should brighten even the dullest moments. It is called: ' The dinitration of *p*-Dimethylaminoacetanilide,' but if your tastes do not run in that direction you could always settle down with ' The reactivity of Resorcinol Monoalkyl Ethers towards Diazonium Compounds.' Then again, there is what, to me, suggests a choice mystery yarn called: ' The 3-halogeno-1-nitro, -1-amino-, and -1-hydroxy Naphthalenes,' but really discerning readers might take a chance with ' The action of Bromine on 2- and 6- Chloro- and 2- and 6-Iodo-3-bromophenols.' Not till the last chapter, I understand, does the gallant Bromine lay by the heels the secret service agent, Iodo-3, and his gang of ruffians. ' The direct nitration of 5-Chloro-3-hydroxy- and of 5-Chloro-3-nitro-anisole ' definitely has its moments, but if you should want something definitely straightforward and equally as entertaining I should wholeheartedly recommend ' Thio-*o*-Toluidine: its preparation by synthesis and by the action of Sulphur on *o*-Toluidine in the presence of Litharge.' I can hardly wait to see your shining faces on Monday morning."

It is only when highly technical literature falls into

the hands of the uninitiated that we are reminded of the remoteness of some of the subjects dealt with from the problems of the moment. Works of a similar character may be found in any technical college in the country, but it is sincerely to be hoped that they will not be taken as typical of the chemical literature which the student of to-day is expected to study. We imagine " Northerner's " attitude towards the chemical library at Huddersfield is very much like that of " A.P.H." towards the long list of trade and technical journals which, according to his article in " Punch " last week, it had not been his personal privilege to peruse. " A.P.H." has the daring to tell Mr. " Punch " that he has never met a reader of THE CHEMICAL AGE. What loss has been his ! *Per contra:* how many readers of THE CHEMICAL AGE know who " A.P.H." is? Maybe some have met him as a full-blown Pearly, if not, as a bargee on the Thames. His confession of ignorance is alarming, coming as it does from one who himself operates from Fleet Street. We would thank him for introducing us to the world of mirth. We like the broad rollicking spirit of sympathy he displays for his airy brethren of the paper ring. Perhaps, when he has got over his fear of drink (for M.P.'s), he will meet us, so that we may offer him a taste of our old Orange Bitters. We feel we should be more widely known. There are Comic Cuts even in chemistry; in fact, it is often well not to take the Burlington House sort too seriously.

The Organisation of I.C.I.

MR. H. J. MITCHELL, director of Imperial Chemical Industries, Ltd., who was primarily responsible for setting up the scheme which came into operation at the time of the merger in 1926, describes in the current issue of the " I.C.I. Magazine " the main principles which underlie the company's organisation. His article shows how a vast, close-knit organisation with a common aim has been created from a mass of varying interests. Technically, Imperial Chemical Industries, Ltd., is a holding company, owning the share capital, either in whole or in part, of various subsidiary and associated companies, but in practice it is primarily a manufacturing company, owning branches at home and overseas. The problem which faced the board at the outset was, Mr. Mitchell points out, to devise a form of administration which, while providing elasticity and rapidity of decision, would ensure the adoption of a common policy throughout the entire company and at the same time prevent overlapping and wasteful duplication—in other words, a true amalgamation and not merely a financial one. It had to try to avoid the two extremes of complete centralisation on the one hand or a loose financial merging on the other. In order that the problem could be fully appreciated, the board had, in the early stages, to have a considerable degree of centralisation and to experiment somewhat. This was unavoidable for a period, but eventually the present system of organisation was evolved, a system which functions effectively, especially when one realises the size and complexity of the business which it administers. The directors have many enterprises to conduct, many departments to control, and if, as is undoubtedly the case, they have confounded their critics by devising machinery which runs smoothly, it is due in no small measure to the loyal sentiments which pervade the whole fabric of the company.

The organisation differs from many others in that its theory is that it is better from a psychological point of view for a man to be told what he *may not* do without higher authority, rather than to define what he *may do*. In other words, make clear to your people just how far they can act independently and that they are expected to go that length without bothering their chiefs, unless they really want advice.

Central Administration

TWO charts accompany Mr. Mitchell's article, one showing the administration and its main personnel and the other the various units subsidiary to or associated with Imperial Chemical Industries, Ltd., and their main products. At the top there is the board with the chairman at the head and Lord Reading as president, with fourteen other directors, of whom eight give their whole time to the service of the company. The whole-time directors form the general purposes committee and three of them constitute the finance committee together with the chairman and president. Next there is the central administration committee, which has specific powers of decision conferred on it by the chairman. Important matters requiring decision are submitted through the medium of the central administration committee, and, if within its powers, that committee decides the issue and reports to the general purposes committee—if not, it passes the matter up with its recommendation. The " clearing house " activities of the central administration committee make certain that no policy adopted by one unit can prejudice the interests of another.

The manufacturing units are organised into eight operating groups, each with its defined field of activity, entitled for simple reference the alkali group, the dyestuffs group, the explosives group, the fertilisers and synthetic products group, the general chemicals group, the leather cloth group, the lime group and the metals group. The statutory or legal " board " of the companies is I.C.I. itself, and thus the final responsibility rests on the members of the I.C.I. board. The responsibility for the day-to-day administration of each operating group rests with its chairman and his delegate board, made up of whole-time officials (both of the group itself and of head office) appointed by I.C.I. and vested with authority to take action within defined limits. Matters of major importance or of policy have to be submitted to head office. The co-ordination of policy in matters common to all groups is made effective by constant contact between the group heads, by head office representation on the delegate boards, and by the functions of the several head office departments, such as the treasury, the secretariat, sales, labour, etc. The "associated" companies, on the other hand, are administered by boards of directors upon which I.C.I. is represented by some of the officials, who keep in close contact with the management and give general guidance, direction on I.C.I. policy and all possible assistance in administration. The overseas companies are directed and managed by local boards and although I.C.I. does not exercise control it is kept cognisant by these boards of all matters affecting questions of major policy so that any possible conflict of interests is avoided. There is available to these companies the advice of all departments of I.C.I. which they may desire to consult, and this liaison contact rests primarily with the central sales department, so that a common home and foreign sales policy is pursued.

Specifications for Laboratory Reagents

Some Questions for the Fine Chemical Manufacturer

BEHIND the framing of specifications for chemicals used as analytical reagents is a story reflecting many interesting facts. The most recent standards for reagents published in this country are those issued jointly by The British Drug Houses, Ltd., and Hopkin and Williams, Ltd., and entitled " 'AnalaR' Standards for Laboratory Chemicals." In this book, to which reference is made elsewhere in this issue of THE CHEMICAL AGE, exact working details are given of the tests which every chemical of "AnalaR" quality must pass, whilst each monograph gives, in tabular form, the maximum limits of impurities corresponding with the demands made by the specification.

The Modern Character of Specifications

Even a cursory glance through the "AnalaR" book reveals the modern character of the specifications. The chemist finds repeatedly that the familiar tests of his student days have been discarded. The older methods are retained only when they offer adequate delicacy coupled with soundness of chemical principle. The tests for such impurities as chlorides, sulphates, iron and heavy metals are now established on a strictly quantitative basis. Such phrases as " not more than a slight opalescence " and " not more than a faint darkening " have been eliminated. In those cases where a positive appearance is permitted, the test is accurately judged by comparison with a standard control made under carefully specified conditions. The fact that a solution of the reagent under examination sometimes influences the course of a test by depressing its sensitivity has not been overlooked. An instance of this is found in the detection of sulphate in sodium chloride where after the addition of barium chloride the test must remain completely free from turbidity or precipitate for at least 24 hours. Empiricism has disappeared and the spirit of scientific precision reigns in its stead. The analyst and the research chemist may now safely regard their reagents in the same light as they do their physical instruments; both may embody errors but only errors of known magnitude.

The test for the limit of magnesium in calcium carbonate is a good illustration of the application of modern analytical technique. Until recently, most chemists would have been ready to believe that, after precipitation of the calcium as oxalate, it would be possible to detect traces of magnesium in the filtrate. The recent discovery by I. M. Kolthoff ("Chem. Weekblad," 1927, *24*, 254) of the extremely delicate test for magnesium using titan yellow has effectively modified older ideas in regard to this separation. Experiment shows that when calcium is removed as oxalate, even from solutions containing free acetic acid, appreciable traces of magnesium are invariably adsorbed on the precipitate. It has, however, been demonstrated by R. C. Wiley (" Ind. Eng. Chem.," Anal. Ed., 1931, *3*, 127) that if the calcium is removed from acetic acid solution as calcium molybdate no adsorption of magnesium occurs. Thus, since the titan yellow test is employed in conjunction with this separation in the "AnalaR" specification it has been possible for the first time to establish a genuine standard limiting the amount of magnesium in calcium carbonate to the merest trace.

Improved Analytical Technique

The test for copper in lead acetate is another interesting example of improved analytical technique. The test is conducted by adding a little pyridine to a slightly acid solution of the lead acetate followed by ammonium thiocyanate and chloroform. After shaking and allowing the immiscible liquids to separate the colour of the chloroform layer is examined. This method for the determination of minute traces of copper was first suggested by R. Biazzo (" Ann. Chim. Appl. Roma," 1926, *16*, 96) and is a micro-colorimetric application of the copper pyridine thiocyanate process for the gravimetric determination of copper originated by G. Spacu ("Bul. Soc. Stünte Cluj," 1922, *1*, 352). In " 'AnalaR' Standards for Laboratory Chemicals," the method is not only employed in the specifications for lead salts and lead metal but is also applied as a delicate test for thiocyanate in some of the ammonium salts as, for instance, amonium chloride.

The increasing demand for higher standards of purity for analytical reagents has led to the adoption of an extremely delicate test for phosphate. This is carried out by adding ammonium molybdate to an acid solution of the reagent under examination followed by a solution containing sodium metabisulphite and monomethyl-*p*-aminophenol sulphate, and the mixture is finally warmed at 60° C. for 5 minutes. Under these conditions extremely faint traces of phosphate produce a blue colour the intensity of which is proportional to the amount of phosphate present. This test, suggested by Ernst and Emilio Tschopp (" Helv. Chim. Acta," 1932, *15*, 793), is a modification of earlier proposals in which other organic reducing agents were employed to convert the phosphomolybdate into the coloured compound of the lower molybdenum oxide. This particular procedure is especially well suited for controlling the purity of analytical reagents now that so many of them are used for delicate biochemical research.

Importance of High Quality Ether

The importance of using high quality ether for analytical work cannot be over estimated. Apart from the obvious interference with the course of analyses, the presence of peroxide in ether has repeatedly led to very violent explosions (L. Brandt, " Chem. Ztg.," 1927, *51*, 981, see also " Pharm. Zentr.," 1933, *74*, 772). The maximum limit of peroxide permitted in Ether "AnalaR" is 0.05 part per million, the test adopted being that of G. Middleton and F. C. Hymas (" Analyst," 1928, *53*, 201), who use the extremely sensitive ferrous thiocyanate reagent. This is undoubtedly the most delicate and reliable method yet proposed for detecting this dangerous impurity.

In the specification for trichloracetic acid "AnalaR" the following rather unusual test for sulphate is found :—

" Dissolve 5 grams in 10 c.c. of water and add 40 c.c. of a 0.5 per cent. w/v solution of benzidine in acetone. No opalescence or turbidity should be produced."

The above procedure ensures that trichloracetic acid conforming to the "AnalaR" standard shall not contain more than 0.001 per cent. of sulphur calculated as SO_4. This reagent is used in the colorimetric determination of sulphate in blood by the method of D. P. Cuthbertson and S. L. Tompsett (" Biochem. J.," 1931, *25*, 1,237). In view of its possible adaptation in other spheres of work it will be interesting to present an abstract of this ingenious process.

Adaptation in other Spheres of Work

To 2 c.c. of blood, serum or plasma are added 6 c.c. of water and 2 c.c. of a 20 per cent. aqueous solution of trichloracetic acid, the mixture being shaken and then centrifuged. Into another 15 c.c. centrifuge tube 2.5 c.c. of the supernatant liquid is measured, followed by 5 c.c. of a 0.5 per cent. solution of benzidine in acetone. After mixing and standing for 30 minutes the contents of the tube are centrifuged, the supernatant liquid poured off, the precipitate of benzidine sulphate washed twice with acetone and the tube then inverted over filter paper until the interior has dried. The precipitate in the tube is then dissolved by warming with 1 c.c. of normal hydrochloric acid. After cooling 0.5 c.c. of a 0.1 per cent. aqueous solution of sodium nitrite is added and also, after the elapse of 1 minute, 2.5 c.c. of a 15 per cent. aqueous solution of sodium hydroxide followed by 2.5 c.c. of a 1 per cent. solution of thymol in 10 per cent. aqueous sodium hydroxide. The colour produced is compared with standards made by mixing 2 c.c. of standard benzidine hydrochloride solution with 1 c.c. of the sodium nitrite solution and, after standing 1 minute, adding 5 c.c. of 15 per cent. sodium hydroxide, shaking and mixing with 5 c.c. of the alkaline thymol solution. The standard benzidine hydrochloride solution is prepared by diluting a 0.40142 per cent. solution of the hydrochloride in normal hydrochloric acid (1 c.c. of which is equivalent to 0.5 mg. of sulphur) so that a series of standards are obtained in

which 1 c.c. contains benzidine equivalent to 0.0025 mg. up to 0.08 mg. of sulphur.

In the specification for amyl alcohol "AnalaR" there is a test which directs that the sample under examination should be used for the determination of fat in milk using the Gerber butyrometer tube, and the result obtained should not differ by more than 0.05 per cent. from a determination conducted on the same milk by the Röse-Gottlieb method. The rapidity with which this important determination can be accomplished by simply mixing the milk with sulphuric acid and amyl alcohol, and centrifuging in the Gerber apparatus is well known and the method is therefore extensively used by analysts. It must, therefore, have been a disturbing revelation to many when it was shown by J. Houston ("Analyst," 1933, *58*, 151) that apparently satisfactory amyl alcohol might well contain oily impurities in sufficient quantity to falsify the results of fat determinations by almost 0.5 per cent. These conclusions were subsequently confirmed by A. More ("Analyst," 1933, *58*, 277) and by J. Golding ("Analyst," 1933, *58*, 276 and 531). The use of "AnalaR" amyl alcohol should materially contribute towards minimising the worries of the many analysts concerned with the examination of milk.

High Standards of Purity

For one more illustration of the high standard of purity characteristic of "AnalaR" chemicals we will select a case of particular interest to the metallurgist, namely, tin metal. The specification includes limit tests for lead, copper and bismuth. The separation of minute traces of these metals from a solution of 5 grams of tin is accomplished by extraction, under specified conditions, with a chloroformic solution of diphenylthiocarbazone. In this manner all losses due to adsorption are avoided and it is therefore safe to say that, for the first time, the maximum limits of impurities quoted for tin of reagent quality are in accordance with the real facts.

Mention of diphenylthiocarbazone leads naturally to a consideration of the many new organic reagents which have been introduced during the last few years. In "The B.D.H. Book of Reagents for 'Spot' Tests and Delicate Analysis" practical working details for the use of sixty of these are given. To mention but two, taken at random, there is *p*-dimethylamino-benzal-rhodanine which is such a sensitive reagent for silver that it will readily detect that metal in water which has been in contact with silver chloride (F. Feigl, "Z. Anal. Chem.," 1928, *74*, 380). Also, thioglycollic acid, originally recommended by E. Lyons ("J. Amer. Chem. Soc.," 1927, *49*, 1916) for the colorimetric determination of ferrous and ferric iron, is finding ever-increasing application in critical analysis. It is capable of detecting 1 part of iron in 5 million parts of solution. It is hardly necessary to observe that such reagents need to be pure! The production of these chemicals is an achievement that might well engender some excusable pride on the part of the manufacturer.

Oxidation-Reduction Indicators

Another valuable aid to scientific advancement in the fields of biochemistry and metallurgy is the provision of a series of oxidation-reduction indicators. The use and manufacture of these complex organic compounds has been very considerably extended, thus rendering it possible to conduct certain analyses more accurately and more rapidly than hitherto. An interesting example is phenol-indo-2:6 dichlorophenol which has been recommended by J. Tillmans and his co-workers for the determination of vitamin C in fruit juices ("Z. Unters Lebensm.," 1932, *63*, 1). In the metallurgical field the titration of zinc with standard ferrocyanide has become a simple and certain determination since the introduction of diphenylbenzidine as an internal oxidation-reduction indicator by W. H. Cone and L. C. Cady ("J. Amer. Chem. Soc.," 1927, *49*, 356).

Enough has been written to demonstrate that the study of chemical specifications, far from being tedious, is full of interest and instruction. Analytical reagents of a high degree of purity are indispensable accessories in every branch of scientific research. The chief care of the fine chemical manufacturer should be to avoid letting "virtue seek remuneration for the thing it was." All must be new: new standards for new chemicals to satisfy new demands created by new discoveries.

Phenols and Phenol Derivatives

The Importance of Purity

THE term "analytically pure" conveys the impression of 100 per cent. purity, and such degree of purity is rarely attained in commercial practice. Nevertheless most of the fine chemicals produced by Monsanto Chemicals, Ltd., approach this degree of purity. The Monsanto concern have long been famous for the quality of their phenols, and their commercial supplies of phenol (carbolic acid) are of greater purity than any others on the market. Where there is a need for phenol of the highest degree of purity, research workers and others could not do better than to ask for "Monsanto detached crystal," the melting point of which is 40.8° C. Since the melting point of 100 per cent. pure phenol is 41.0° C., it will be seen that Monsanto detached phenol is practically 100 per cent. pure. Similarly, supplies of practically 100 per cent. pure ortho-cresol, meta-cresol and para-cresol are available, and some of the xylenols are offered, together with the alkaline derivatives of these products, for example, sodium phenate and potassium cresylate. The chloro derivatives of the phenols are regularly manufactured in technical and pure qualities, such as para-chlorphenol, ortho-chlorphenol, para-chlormetacresol, and para-chlormetaxylenol. Apart from these pure materials there is often need in industrial research for supplies of cresylic acid to a constant composition, and in their ability to meet such requests Monsanto Chemicals, Ltd., are pre-eminent. In the field of synthetic resins, the chemical reactions involved are so complex that it is essential to stabilise as many of the potentially variable factors as possible. Control of time and temperature count for very little if the basic reagents are variable. The task of the researcher is therefore greatly simplified if he is convinced that his phenolic substances are the same from one experiment to another. Such guarantees are given by Monsanto Chemicals, Ltd.

Purity of Analytical Reagents

A Pioneer Trade Mark

AT the Sudbury works of The General Chemical and Pharmaceutical Co., Ltd., many hundreds of general laboratory chemicals and analytical reagents are manufactured. The company's policy of continually improving the standard of purity of analytical reagents has had an important bearing on the volume of its export trade, Judex reagents now being recognised as being in many instances of definitely higher purity than the corresponding products of the leading Continental manufacturers. In this connection, it is of interest to note, that in cases where reagents of special purity have been required, a number of continental governments have selected Judex A.R. reagents in preference to the corresponding products of the best continental makers.

In accordance with a policy adopted some years ago the company does not issue any book setting out the standards to which its Judex analytical reagents conform, but every effort which has been made to increase the purity of analytical reagents by the demand for higher standards of test has had the company's whole-hearted approval, and it has continually maintained its own manufacturing policy directed to ensuring that each Judex reagent is of at least as high purity as is required to comply with the most stringent individual recognised British specifications.

The company welcomes the use of trade marks as denoting the chemicals supplied and guaranteed by a particular maker; indeed, it was actually the pioneer in this country of the application of a registered trade mark to analytical reagents. Its view is that a step which can, more than any other, assist in upholding the security associated with the use of the letters "A.R." is the laying down by some independent and official body of a high standard for all reagents to which the designation "A.R." may be attached.

The policy of The General Chemical and Pharmaceutical Co., Ltd., is by improved methods of manufacture and the strictest analytical control, to ensure that whenever such official specifications come to be compiled the body engaged in drafting the standards may be assured that there are British manufacturers willing to comply with the most stringent specifications agreed upon.

The Limitations of Chemical Analysis

A DISCUSSION on "The Limitations of Chemical Analysis" was opened by Mr. C. A. Klein and Dr. J. J. Fox at a joint meeting of the Oil and Colour Chemists' Association and the London and South Eastern Counties Section of the Institute of Chemistry, held at the Institute of Chemistry, on January 16. Mr. F. G. Edmed (chairman of the London South Eastern Counties Section of the Institute) and Mr. G. A. Campbell (president of the Oil and Colour Chemists' Association) jointly occupied the chair.

Mr. C. A. KLEIN dealt with the subject from the point of view of one who had been engaged in industry for some 30 years. Business in materials to the value of millions sterling in the course of every year depended on accurate analysis and industrial operations depended in a large measure on the accuracy of the control afforded by chemical analysis. That point needed to be strongly emphasised because he personally had seen during the past 30 years a big change in the attitude of chemists towards works chemistry, which in the days when he was a student was regarded as a sort of poor relation to chemistry. Organic chemists 30 years ago had a somewhat scornful attitude towards works tests which was quite unjustified.

A Fetish of the Analyst

Discussing the conditions which determined the limitations of chemical analysis, Mr. Klein expressed the view that these limitations could only really be determined by the limitations of our own true scientific knowledge. As a matter of fact, he often wondered whether analysts as a body were applying as quickly as they ought to do some of the discoveries that were being made in pure science. There seemed to be a belief among young chemists that any standard text-book on quantitative analysis was created in Heaven, bound in gilt and just dropped from above, and that the methods set out in these standard text-books were interchangeable, irrefutable, and must be persisted in for ever, although happily, in recent years that attitude of mind was gradually disappearing. Speaking of quantitative analysis in particular, Mr. Klein said that mere quantitative analysis, except in the case of very few materials, gave not more than half the picture. It could best be described as mass analysis with no regard for the qualitative or constitutional aspects of any material.

The fetish which chemists had in making their analytical results add up to 100 with no difference figure was an attitude which Mr. Klein regarded as perfectly absurd. That fetish was showing a tendency to die, but it would die a pretty hard death because commercial men usually liked a figure that balanced perfectly to 100.

Speaking of the training of young chemists, Mr. Klein said it would be the greatest advantage if they were made to carry out complete analyses until they got them right, and to explain to them particularly why they had gone wrong. If that were done we should probably get an outlook on analytical chemistry which would help considerably. He realised that the university, as such, could not possibly turn out a finished analyst having regard to the short amount of time that could be devoted for studies in that direction, but the young student would be better trained if he were made to carry out half a dozen analyses properly and to have explained to him his failures, because there was always a reason why an analysis went wrong.

Chairs of Analytical Chemistry

Dr. J. J. FOX, after expressing himself strongly as to the need for some Chairs of Analytical Chemistry in this country, said that whilst there is a good deal to be said for analytical chemistry as a subject for study he personally was interested in the application of physical methods to chemical analysis. Indeed, he had a sort of mania in that direction and preferred to find a physical method and to avoid the chemical if possible. It was more than 30 years since he started his first investigation in this connection and although at the time people thought there was something wrong with him he doubted whether there was a single laboratory in the country to-day which did not have a quartz spectrograph.

The Present-Day Attitude Towards the Works Chemist

Referring to the value of analysis in paints, Dr. Fox said that if he wanted a paint he would know what to ask for and would know that he was getting it. Moreover, there were in the old days the craftsmen to deal with the material when it was manufactured, but the position to-day was very different having regard to the large quantities of ready mixed paints that were on the market. The simple paints which he had had to deal with 30 or 40 years ago had been replaced by all sorts of things to-day and it was necessary to deal with things which in a way were not capable of being examined chemically, and therefore it was necessary to come down to some physical method. There was, for example, the particle size in connection with which Mr. Klein had been so actively engaged, and we also wanted to know a little about what the film would look like and how it was going to behave. There were two things to which regard should be paid, especially in varnishes, namely, dispersivity—if there was such a word—and viscosity. At the same time, in certain directions there were limitations even to physical methods and it was then necessary to carry out the analysis by physical and chemical methods combined with experience in interpreting what had been done.

Particle Size in Specifications

In connection with specifications, Dr. Fox drew special attention to zinc oxide and white lead and said that although in the past consideration had been given to whether the percentage of ZnO was 99.5 per cent. or some such figure, there was little said in the specification about particle size, and nothing about particle form, which was just as important. Neither was anything said about dispersivity.

Dr. L. A. JORDAN commented on the remarks by Dr. Fox as to wasted effort in chemical analysis particularly in analysing zinc oxide and said he himself, since the Paint Research Station had been in operation, had been pointing out the necessity for avoiding this wasted effort. A few years ago he had come to the conclusion that the amount of laboratory activity spent in analysing zinc oxide, which could not be carried out under about three days, was perfectly appalling and absolutely of no value at all. He felt it was time someone spoke strongly about the manner in which the results of half a dozen people in carrying out what might be termed a chemical procedure, as distinct from the physical, showed as wide variation in results as was usually seen in the ordinary student courses in the university class, and this could be very terrible. In the case of the university student the teacher could write "tosh" against the result, but once that same student left the university and became a paint chemist or any other chemist in practice nobody dreamed of suggesting that the chemist was wrong. It was always the method that was wrong.

The Basis of Examination

Dr. STERN said the whole position required a little clarification with regard to chemical analysis and physical tests. Surely the basis of any examination whether chemical or physical must depend upon what was going to be done with the material afterwards. Taking the case of an essential oil, the buyer would want to know whether it was what was known as pure or whether it came up to any definite standard, and as long as the men obtained an oil which was within 1 per cent. of what he required, he would probably be satisfied. On the other hand, there would be cases in which a material, for example, was bought for its content of, say, chromium oxide and in such a case a very definite analysis would be required.

Dr. J. O. CUTTER remarked that the primary need of the paint and varnish industry to-day was a knowledge on the scientific side of the character which, as had been mentioned, had run through the craftsmen for the past 50 years, which would enable us to devise the tests which were required.

Mr. BURN suggested that there is not so much a limitation of chemical analysis as a limitation of the analyst. In other words, the works chemist seemed to be extremely lazy and rarely troubled to work out his own methods, preferring to wait for the research chemist to provide him with cut and dried methods.

Dr. FOX said he could not allow this expression of opinion to pass without disagreeing with it. Knowing many works chemists he was aware of the difficulties under which they worked, but he was also aware of the valuable work which these men did and that the directors got full value for the money they paid them. He denied any suggestion that works chemists as a whole were behind the times. The trouble was that works chemists were expected within two or three days to carry out work which constituted a lengthy research problem.

Mr. KLEIN, in winding up the discussion, expressed the view that the attitude towards the works chemists, which was so often encountered was one of the most regrettable things in the profession. His own view was that the research chemist who was too big and too clever to consult the works chemist or the skilled craftsman or skilled worker in a chemical works was losing a great deal. These men had brains and although they might not be observing quite on the same lines as the research chemist, their observations were nevertheless sound and could not be ignored.

Chemicals for the Use of the Analyst

A Book of Specifications Governing Purity

IT is hardly necessary to dwell on the importance of purity and correctness of composition in chemicals intended for analytical use. Scientific control is everywhere extending in industry, a modern manufacturing plant almost always has its laboratory for the examination of raw materials, the checking of partially processed materials and the testing of finished products, and in this work chemical analysis plays a very large part. Important tools of the analyst are the reagents which are used in the tests, and unless these reagents are of adequate purity the whole of the analytical work may be false and therefore misleading. Monetary values to the extent of thousands of pounds may be involved in such analyses as when a furnace full of steel is held waiting for the results of the chemists' analysis. It will therefore be appreciated that analytical reagents play a part in the successful conduct of an industrial nation's affairs, which is far more important than the small monetary value of the reagents themselves would indicate.

Hopkin and Williams, Ltd., enjoy the distinction of being the first British fine chemical manufacturers to issue a book of definite specifications governing the purity of its own analytical reagents. This book first appeared in 1911, and was revised in 1925 and in 1931. During the past year a further innovation has been introduced which will be welcomed by all who have the interests of the British fine chemical industry at heart. Hopkin and Williams, Ltd., have collaborated with The British Drug Houses, Ltd. (who themselves have maintained, in the past, their own book of standards for analytical reagents), and, as a result of this collaboration, a new book has been produced, incorporating all the best features of the two earlier books, completely re-written in the light of modern analytical practice. In the preparation of the new specifications considerable investigation has been carried out on the technique of detecting minimal quantities of impurities and a number of new methods of testing are published for the first time in this book.

Standards for Laboratory Chemicals

The book is entitled " 'AnalaR' Standards for Laboratory Chemicals." The joint publishers have abandoned the use of the general description "A.R." and have applied the new word "AnalaR" (a registered trade-mark) to their products. To them, the position is now as follows: "A.R." means nothing but "AnalaR" means the specifications in " 'AnalaR' Standards for Laboratory Chemicals."

This new volume of standards (price 3s. 6d.) comprises 295 pages and contains specifications for 220 substances, including the customary inorganic reagents, chemicals for the accurate standardisation of volumetric solutions and for the preparation of buffer solutions, organic reagents and indicators—that is, practically everything that is likely to be required in a wide range of chemical analysis or research. At the head of each monograph is placed a table of the maximum limits of the impurities which may possibly be present in a batch of chemicals passing the tests which are given. These figures are of considerable value to the analyst, since they apprise him of the ratio between the amount of constituent (*e.g.*, iron) for which he is looking in the sample under test and the amount which may possibly be contributed by the reagents used in the test. If this latter contribution is negligible it may be disregarded; if not, a blank determination should be carried out alongside the main experiment.

The chemicals which conform to the very high standards of purity laid down in " 'AnalaR' Standards " are carefully packed and labelled. Hopkin and Williams, Ltd., being a progressive concern, have broken with the long tradition that the bottles containing solid chemicals must be closed either with a glass stopper (which frequently becomes irremovably cemented in place) or else with a cork (a clumsy and archaic method). The firm's solid " AnalaR " chemicals are now packed in an amber glass bottle (to minimise the deleterious effect of light upon the contents) closed with a neat moulded screw cap, which combines the advantages of tight closure with quick and easy removal. The label has also been re-designed and now carries a statement of the formula and molecular weight of the substance, the percentage content of active material (where applicable) and the table of the maximum limits of impurities. It is, perhaps, not too much to claim that this series of "AnalaR" chemicals represents one of the most noteworthy achievements of the British fine chemical industry.

Modern Organic Reagents

Until recently, organic reagents found but little application in inorganic analysis. Many chemists were, perhaps, only acquainted with two such reagents—cupferron and dimethylglyoxime. During the last twenty years, however, many more organic compounds have been applied to the problems of inorganic analysis, in many cases with conspicuous success. The new reagents are in some cases extremely sensitive, in some cases entirely specific, in regard to those ions for which they find application, and this has lead to the conduct of a vast amount of research work in this field, which has been reported in chemical journals of all nationalities. The development of the subject is, in many cases, too recent for the results to have found their way into the standard text-books.

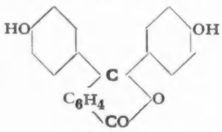
Nor is this all. Claims have been advanced, by some workers, on behalf of some of these reagents which are, to say the least, unduly optimistic, and which may lead astray anyone who relies absolutely on these statements. Hopkin and Williams, Ltd., who, in the ordinary course of their business, have been called upon to supply these reagents, have realised that it would be extremely valuable to many chemists to possess a compendium of up-to-date and reliable information concerning the employment of these reagents. Accordingly, the staff of the company's research laboratory has collected together the available information and has published it in a handy volume entitled "Organic Reagents for Metals," of which the second edition has just appeared. This book (price 1s. 3d.) comprises 107 pages and has monographs relating to 26 reagents. Each monograph contains explicit directions for the more important uses of each reagent, sufficiently full to enable the reader to work from the text without the necessity of going to the original literature for details.

Some New Indicators for the Analyst

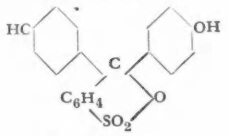
Their Application in Volumetric Analysis

SOME new indicators and other reagents employed in volumetric analysis were described by Dr. A. D. Mitchell, F.I.C., in a lecture delivered before the Institute of Chemistry on October 19, 1934.

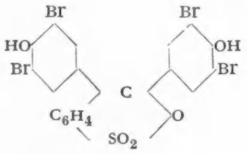
The introduction of acidimetric indicators of the sulphonephthalein type, mostly by Clark and Lubs (" J. Wash. Acad. Sci.," 1915, *5*, 610; 1916, *6*, 481) and by Cohen (" U.S. Public Health Reports," 1923, *38*, 199), effected a great improvement, and a sufficient range is available to displace almost entirely the older indicators, such as azo dyes, phthaleins and natural colouring matters. Their relation to the phthaleins is indicated in the following diagram, showing phenolphthalein, phenol-red (phenolsulphonephthalein), and bromophenol-blue (tetrabromophenolsulphonephthalein) :—



Phenolphthalein.



Phenol-red.



Bromophenol-blue.

Their chief advantage is their very sharp colour, and moreover, they are not very sensitive to changes of temperature.

Bromophenol-blue, which has almost the same *p*H range as methyl-orange, is a much better indicator for use in artificial light in spite of the fact that it exhibits dichroism. This phenomenon is a disadvantage of some of the original indicators of this class, but Cohen synthesised several with a view to overcome this handicap : bromocresol-green (*p*H range 3.6-5.2 ; corresponding to a change from yellow to blue) is an example, and is comparable in its range with bromophenol-blue and methyl-red.

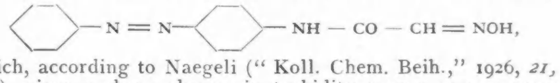
Screened indicators may be illustrated by the case of methyl-orange. Several attempts have been made to add other colouring matters which would make the colour change of this indicator more readily detectable. Luther, in 1907, suggested this procedure, and, later, Moerk (" Amer. J. Pharm.," 1921, *93*, 675) recommended the addition of 2.5 g. of indigo-carmine to 1 g. of the indicator in 1 litre of solution. Hickman and Linstead (" J. Chem. Soc.," 1922, *121*, 2,501) achieved the desired effect by adding 1.4 g. of xylene-cyanole FF to 1 g. of the indicator in 500 ml. of 50 per cent. alcohol. Although the cyanole itself does not undergo any appreciable change over the *p*H range concerned, yet it makes the end-point clearer, especially in artificial light, the change on passing from alkaline to acid solution being from green to magenta, with a neutral grey colour at *p*H 3.8.

The cyanole shows strong absorption in the yellowish-orange region, and, roughly, it may be said that the relatively small shift in the absorption of methyl-orange on its acidification is emphasised by having the range of unaltered transmitted light considerably reduced.

Fluorescence and Turbidity Indicators

Two new types of fluorescence indicator have recently been introduced and, although their use is to some extent still in the experimental stage, they will undoubtedly attain a useful place later. Umbelliferone (Robl, "Ber.," 1926, *59*, 1725), 7-hydroxycoumarin, may be taken at typical of the first sort, namely, fluorescence indicators : in ultra-violet light, *e.g.*, that of the Hanovia lamp, it shows a sharp change to a sky-blue fluorescence as the *p*H rises from 6.5 to 7.6, thus covering the region of neutrality. It has already proved of value in the titration of strongly coloured liquids, such as fruit juices. Quinine shows two such changes, one at *p*H 6 and the other at *p*H 9.5-10.0; the former is very good for strong acids in very dilute solution. Both α- and β-naphthols show marked fluorescence in alkaline solution, but none in acid solution, the line of demarcation being very sharp.

Turbidity indicators, as a type have not been thoroughly tested, but an example is *iso*nitroso-*p*-acetamido-azobenzene,



which, according to Naegeli (" Koll. Chem. Beih.," 1926, *21*, 306), gives a sharp change in turbidity over a very narrow *p*H range, 10.80-11.01, and is therefore suitable for the direct titration of a very weak acid, such as boric acid. Unfortunately, since indicators of this type appear to depend on a colloidal action, it may happen that their utility is too greatly affected by factors such as other colloids, multivalent ions, salt concentration, temperature, presence of alcohol, etc.

Mixed Indicators

The suitable admixture of indicators of different colours and *p*H ranges enables one to obtain sharp colour changes at narrow and selected values of *p*H. Three examples may be quoted out of some dozens that have been suggested.

(*a*) With a mixture of equal parts of neutral-red and methylene-blue, which gives a change from violet-blue to green as one passes from acidic to alkaline solution at *p*H 7, one is able to titrate acetic acid by ammonia or *vice versa;* being a weak acid and a weak base respectively, and of about the same strength, they give *p*H 7 when present in stoicheiometric proportion, but the effects of hydrolysis make it impossible to perform the titration accurately except with an indicator of very narrow range, the *p*H titration curve being too flat.

(*b*) α-Naphtholphthalein (1 part) and phenolphthalein (2 parts) give a change point (pale rose through green to violet) at *p*H 9.6, corresponding to the titration of phosphoric acid to the dibasic stage, HPO_4''. This titration is not very satisfactory with phenolphthalein alone because its range is about 8.5-10.

(*c*) A mixture of thymol-blue (6 parts) and cresol-red (1 part) gives the following changes :—

*p*H	8.4	8.3	8.2
Colour	violet	blue	rose

and is therefore recommended by Simpson for titration of carbonates to the bicarbonate stage, an operation for which it has been customary to use phenolphthalein at a temperature of 0° C. and in presence of much sodium chloride.

It must be emphasised, however, that the narrower the *p*H range the more will the accuracy depend upon precise conditions of temperature, foreign salt content and alcoholic content, so that, although these special indicators offer advantages in solutions of pure substances, these advantages may become nebulous when we have to deal with more complex solutions.

Adsorption Indicators

Since Fajans and his collaborators (" Z. Elektrochem.," 1923, *29*, 495 ; " Z. anorg. Chem.," 1924, *137*, 221) introduced adsorption indicators in 1923, there has been a wealth of publications on the subject. It is well known that if silver nitrate is titrated into a solution of a chloride, the precipitated silver chloride adsorbs chloride ions, and these are only removed when a very slight excess of silver is present. If fluorescein is also present in the solution, its anion competes unsuccessfully with the chloride ion for adsorption, and it only achieves its object when the last trace of chloride has just been precipitated. The organic ion is then at once adsorbed, and it shows its presence on the precipitate, not by its own colour, which is that of the solution, but by forming a complex on the surface with the first trace of excess silver. With a suitable concentration of fluorescein (1 mg. per litre) the formation of pink on the precipitate readily shows up against the greenish-yellow solution.

For bromides, eosin is better than fluorescein and is used in higher concentration (10 mg. per litre). Although the reaction is reversible, yet for the reverse titration (bromide into silver) it is better to use a basic indicator, such as rhodamine-6G, instead of an acidic one, since the sign of the

adsorbed ion is reversed, the ion now being that of silver. The persistence of a part of the precipitate in the colloidal state is another factor in these titrations, since in this form it has a large surface available for adsorption, and the colour on the precipitate shows up clearly throughout the liquid.

For chlorides, fluorescein should only be used if the solution is not too dilute (*i.e.*, not weaker than about $N/100$) and if it is neutral or at most very feebly acidic with acetic acid. Dichlorofluorescein (colour changes as for fluorescein) is not subject to these limitations, since it is available in very dilute solution (*e.g.*, for drinking water) and in presence of appreciable concentrations of acetic acid (" J. Amer. Chem. Soc.," 1929, *51*, 3273). Bromophenol-blue and bromocresol-purple, among many other colouring matters, have been used in this titration (" Z. anal. Chem.," 1927, *71*, 235; " Chem.-Weekblad," 1929, *26*, 6).

With bromides and eosin the colour on the precipitate is magenta, which shows up against the red liquid. The indicator is serviceable in dilute solutions and even in $N/10$-nitric acid solutions. Eosin cannot be used for chlorides because it is too strongly adsorbed and would compete too successfully against the comparatively feebly adsorbed chloride ion.

For iodides, eosin may be used, but di-iododimethylfluorescein (" Z. anorg. Chem.," 1924, *137*, 221) is better, the colour on the precipitate being blue-red and that of the liquid orange-red. The latter indicator (5-10 drops of 1 per cent. solution per 100 ml.) gives accurate results for iodide in presence of small amounts of chloride, and then by using fluorescein to determine total iodide plus chloride in a separate portion it is possible by difference to determine the chloride. If the amount of chloride is about equivalent to that of the iodide, however, the amount of iodide found is slightly high, and that of the chloride correspondingly low. The use of adsorption indicators for iodide is valuable because, as is well known, Mohr's chromate indicator fails in this case.

Spectrum Analysis in the Production of Pure Materials

By THOMAS L. TIPPELL

In control work, as well as in research work, a much greater accuracy is now demanded than was hitherto possible. In the field of chemistry this is seen as a need for more rigid control of the purity of substances and a closer adherence to specification. This entails more careful work on the part of the chemist and increases, very frequently, the time required for an investigation, while it also necessitates the utmost reliability in all the reagents used. Such rigid control is only possible when every possible means of applying it has been explored, and thus there is to-day a much more ready acceptance of methods which at one time would have been considered to be more in the province of the physicist than the chemist. One such means of delicate analysis which, after a long period of comparative neglect, is now rapidly gaining in favour, is that of spectrum analysis, and particularly of spectrographic analysis.

Standardisation of Apparatus

Spectrum analysis has its origin in the early years of the nineteenth century, in the discoveries of Fraunhofer, Herschel and Brewster, that the emission spectra of certain metals were obviously different from one another. In 1835, W. H. F. Talbot accomplished the spectrum analysis of lithium and strontium. By 1861, a reasonably efficient spectroscope had been made and Kirchoff and Bunsen had communicated their classical discoveries. Now, however, ensued a period of suspended progress in the use of the spectroscope as an aid to chemical analysis, and for a considerable length of time little was done with the new method of analysis. Two principal factors contributed to this state of affairs. The first was that the apparatus, although ingeniously constructed, did not provide for the sufficiently accurate measurement of wavelengths except with enormous labour and frequent and tedious adjustment which would not find favour with the busy chemist. The second, and important contributing, factor was that electrical development had not yet reached the stage at which it could be easily and commonly applied to the excitation of the characteristic radiations of a substance whose spectrum was to be examined. While simple means of excitation are limited to the flame only a limited number of metals (chiefly the alkali metals) can be persuaded to betray their presence spectroscopically.*

The simplification and standardisation of apparatus which first occurred between 1908 and 1912 with the introduction of the Hilger permanent adjustment type of spectrograph, has continued up to the present day and is still continuing, resulting in the production of apparatus which calls for less and less of the user's time for its maintenance and use, while the standard of performance has appreciably increased during the intervening years. It was, however, very largely the appearance of these early instruments that led to the advances which have been gathering momentum since that day until now spectrography can present a very tangible set of advantages to its user, not as a supplanter of strictly chemical methods but as a companion and supplement to them, lessening their tedium and resolving doubts while it reveals the entirely unsuspected.

Spectrographic analysis possesses four general advantages. In the first place, a single small group of operations involving but one technique at once photographs the spectrum due to the whole of the constituents of a substance. Secondly, the taking of a spectrogram can be performed very rapidly. Thirdly, the spectrogram thus taken forms a permanent record, independent or errors of manipulation in a way that no ordinary record of an analysis can be, always ready to be read again to confirm the results attained. Fourthly, the technique of taking a spectrogram is really simple and can be left to an assistant.

The simple technique involved in taking a spectrum photograph is not fully realised. The spectrograph is always in adjustment, so that all the user has to do in most cases is to introduce the specimen into the arc lamp electrodes, or the spark gap, used as illuminant and see that this is situated exactly in line with the spectrograph. Then a photographic plate having been inserted in the spectrograph, an exposure of a few seconds serves to record the whole spectrum, which can be developed. In some spectrographs a scale of wavelengths is so arranged that it is easily printed in close juxtaposition with the spectrum and developed up with it.

In the type and size of instrument in the greatest general use the whole of the visible and ultra-violet spectrum (down to about 2,000 Å) is recorded on a single photographic plate, and while for many purposes this has obvious advantages in manipulation yet, for certain spectra which have very many lines or where the lines of one substance crowd closely upon those characteristic of another, it is necessary to use an instrument of greater dispersion in which three separate plates are used to cover the whole spectrum. Even in these latter instruments the manipulation necessary has been reduced to an almost negligible amount.

Quantitative Interpretations

A charge that spectrum analysis frequently had laid at its door was that it was essentially qualitative and that its results were not capable of quantitative interpretation. This disadvantage did not long await the attacks of those who wished to gain the utmost developments from spectrum analysis and several different means of solving the problem have been investigated in the last quarter of a century. Now there are available for the user several methods which can be applied without special difficulty. In one of them, that which is most used at the present time, a revolving disc whose edge is cut to a spiral following a definite logarithmic law serves to vary the amount of exposure given through different portions of the slit, so that the resultant spectrum lines vary in length in accordance with their intensities, which, in turn, are related to the quantity of the "impurity" in the main substance in a simple manner.

* Nevertheless, with special technique and powerful flames, Ramage and also Lundegard carry out quantitative spectrography at present.

All quantitative methods of spectrum analysis share one great virtue; that as the concentration of the minor substance decreases (to a limit) the accuracy of the determination increases. This is, of course, the reverse of what is usually experienced in chemical methods of analysis, and may serve to illustrate one of the ways in which spectrum analysis is of special service to the chemist.

This brings us to the application of the spectograph in the analysis and control of reagents of high purity. It is generally appreciated that there is always a possibility in ordinary separations that a precipitate may bring down with it small (but important) proportions of elements other than that for which it is intended. As a result, in quantitative analyses of high accuracy errors may be induced. It is not a difficult matter to examine the spectra of such precipitates, after weighing, to determine the possible presence of such "impurities." Used in this way the spectrometer or spectrograph becomes almost as important in the chemist's laboratory as the balance.

Pure Materials for Spectrum Analysis

When dealing with materials of such high purity as are frequently employed nowadays it is often a matter of extreme difficulty to determine minute quantities of extraneous substances. Spectrum analysis then offers the solution of the problem either by indicating the presence of the minor metals and simplifying the planning of the complete chemical analysis or by enabling quantitative analyses to be made of those constituents which are present in such small quantities as to be difficult of estimation by chemical means. Often a chemical analysis will require considerable quantities of the original substance in order that a sufficient concentration of the minor substances may be arrived at for analytical treatment. Spectrographic methods, however, can be applied to a quite minute sample.

An interesting example of the application of these methods in practice is found in the range of pure and fully-analysed substances that Adam Hilger, Ltd., have put on the market during the last ten years or so. These are marketed under the trade marks " H.S. Brand " and "Specpure." The former consist mainly of very pure metals and rare earths whose supply is said to be the result of world-wide search among commercial and research laboratories. The matter does not end here, however, as an essential part of the programme laid down was the supply with every delivery of these materials of an analysis so accurate and so detailed that the user could rely on it without question and could quote the laboratory number of the material as a specification of its quality in published papers. To this end, spectroscopic methods were added to chemical analysis and the reports include the full data obtained in these ways. In some cases so pure are the materials that only the spectroscopic analysis is possible.

An article by Dr. R. C. Johnson ("Nature," June 9, 1934) gives the purity of several of these materials. It is stated that cadmium and zinc " are of exceptional purity, namely, of more than 99.999 per cent. The zinc contains copper (less than 0.0001 per cent.), lead (about 0.0002 per cent.) and slight traces of calcium and iron. The cadmium contains traces of bismuth, lead and copper, in each case to an extent of less than one part in a million."

Of the " Specpure " substances, which are for the most part very accurately compounded solutions of metallic salts of specified high purity and concentration, the same article states that calcium chloride " is notable for its high general purity of 99.993 per cent. and especially for its complete freedom from strontium. . . . Hönigschmid's recent atomic weight determination was made on material not quite free from strontium. Similarly, chlorides of strontium, aluminium and cobalt, and also powdered silica, all of 99.99 per cent. purity, can be supplied. Lead nitrate with a purity of 99.999 per cent. and containing only traces of bismuth, copper and antimony is also noteworthy."

Some Indicators of Special Analytical Value

Examination of Water for Industrial Purposes

THE analysis of water calls for a high degree of skill in manipulation, as well as sensitive reagents, owing to the small quantities of chemical compounds which have to be determined. The delicacy of the analytical operations is particularly noticeable in the case of the indicators used for those determinations which are made by titration. Sofnol, Ltd., who have specialised for the past 25 years in the treatment of water for industrial purposes, were faced with the necessity many years ago of finding indicators which were more delicate than phenolphthalein and methyl orange, and after a considerable amount of research two indicators were adopted for use in their own laboratories. The greater accuracy of these indicators was so marked that they finally decided to place them on the market, and for some years now they have been making indicators in their own laboratories and supplying them to water chemists.

Sofnol Indicator No. 1 (Sofnol Red) takes the place of methyl orange. Methyl orange changes colour at *p*H 4; Sofnol Red changes colour at *p*H 6.5, that is to say, much nearer the neutrality line. Sofnol Red is, therefore, more sensitive than methyl orange and gives greater accuracy when used in titration. Sofnol Indicator No. 2 (Sofnol Purple) has a *p*H range of 6 to 9.8, or, in other words, it is sensitive to both acids and alkalis; actually, this mixed indicator takes the place of the separate indicators, phenolphthalein and methyl orange. *o*-Cresolphthalein is also recommended for use instead of Phenolphthalein, as the colour is deeper and more brilliant, thus rendering *o*-Cresolphthalein well adapted for titrations in artificial light.

In addition to these three indicators, Sofnol, Ltd., also make a long range of indicators of the sulphonephthalein series. They are thus in a position to supply specially prepared indicators for the delicate analytical work required in connection with water analysis, as well as highly sensitive indicators for general analytical purposes. The necessity for a simplified method of works testing in order to ascertain the composition of both untreated and treated waters led to this firm introducing special testing apparatus consisting of automatic burettes, beakers, pipettes, etc., all mounted in a compact cabinet and produced in a manner which enables results of almost analytical accuracy to be obtained, even by a worker of limited analytical ability. In connection with these sets it is interesting to note that the difficulty experienced years ago with the preparation of standard soap solution, for the determination of hardness has been overcome by the use of a chemically pure soap which is made in the laboratories of Sofnol, Ltd. This soap is supplied either in solution form or as a pure, dry powder which can be weighed out and dissolved in spirit and water to give a standard soap solution. The advantage of Sofnol soap lies in the fact that it gives accurate results with all classes of water, even when a relatively large percentage of magnesia salts is present.

Another product introduced by Sofnol, Ltd., is "Sofnolite," a dry granular CO_2 absorbent which takes the place of liquid caustic potash. The advantage of "Sofnolite" is that the absorption tubes can be filled easily and quickly, accurate results are obtained, and, as the material has a catalyte incorporated in it, change of colour shows when the tube is nearing exhaustion. All of the products mentioned can be obtained in large or small quantities, and interesting booklets are issued in connection with the materials concerned.

Spanish Potash for Denmark

PARTICULARS of a reciprocal agreement to balance the trade during 1934 between Denmark and Spain were published in " Commerce Reports," December 15, 1934. One of the provisions of the agreement concerns the issuance of exchange certificates for the importation into Denmark of 10,000 metric tons of Spanish potash fertiliser salts, independent of previous imports, during 1934. The volume can be raised to 16,400 tons if necessary.

Filter Paper for Analytical Work

Tests at the National Laboratory

FILTERING papers have been made by Evans, Adlard and Co., Ltd., for half a century; this firm is therefore one of the original manufacturers in this country. Since the war the demand for "Postlip" filterings have increased enormously owing to the variety of qualities made, to the purity of the paper (as evinced by the low ash contents), the rapidity of filtration, and by ability to retain fine precipitates. The National Physical Laboratory have put these papers to a very high test and their report proves them to compare favourably with anything in the market. Samples are gladly submitted for testing purposes, both for laboratory or commercial uses.

Five samples of white filter paper in sheets and cut circles were sent to the National Physical Laboratory, together with one sample of thin grey filtering paper in cut circles. The various grades were as follows :—

No. 633a. Medium weight and suitable for rapid filtration.
No. 633b. Heavier weight.
No. 633c. Very similar to the above.
No. 633d. Both suitable for retaining finely divided precipitates.
No. 633e. A heavier paper, filtering more rapidly than 633d.

A sheet of each paper measuring 24½ in. x 24½ in. was divided into two equal portions and carefully ignited. The results obtained in each case indicate that all the papers are very uniform in mineral content.

	Ash per sheet 24½ in. x 12¼ in.	Ash from one 5 in. filter paper circle.
No. 633a.	0.0518 gm.	0.00169 gm.
No. 633b.	0.0564 ,,	0.00184 ,,
No. 633c.	0.0524 ,,	0.00171 ,,
No. 633d.	0.0548 ,,	0.00179 ,,
No. 633e.	0.0934 ,,	0.00305 ,,

The results of filtration tests are largely dependent on the method employed, and rates of filtration published by makers without stating the method are therefore useless for comparison. It was, therefore, considered advisable to obtain samples of a well-known make so that by using the same definite conditions for each kind of paper, a comparison with an article of known quality could be obtained. The method adopted was to use a smooth funnel of 60° fitted with an accurately folded paper of 5 in. diameter. Water maintained at constant level by an automatic arrangement was allowed to flow through during the period of five minutes; by making a series of observations an approximate figure for the rate of flow could be obtained. The figures were subject to somewhat wide variations, but as the conditions were the same for the papers submitted for test and for those of a similar kind of a well-known make, the results are comparable.

	Approximate rate of flow through 5 inch paper circle in 5 minutes.	Similar grade from another maker.
No. 633a.	290 c.c.	240 c.c.
No. 633b.	390 c.c.	280 c.c.
No. 633c.	460 c.c.	460 c.c.
No. 633d.	200 c.c.	140 c.c.

A series of beakers containing equal volumes of a dilute sulphuric acid solution were taken, the contents raised to the boiling point, treated with barium chloride solution and after rapidly cooling, filtered through papers of Nos. 633d. and 633e. and the corresponding grades of comparison paper. The filtrates were in each case perfectly clear and remained so on washing, the precipitates remaining on the filter papers.

In another and more drastic test 1 gm. quantities of an alloy containing 82 per cent. tin and 10 per cent. antimony were treated with nitric acid evaporated to dryness, and then treated with 100 c.c. of 10 per cent. nitric acid and boiled. Without allowing the turbid solutions to settle, they were immediately poured into funnels fitted with the moistened papers. When the solutions had all passed through, the precipitates were washed. It was noted that papers Nos. 633d. and 633e. gave very slightly opalescent solutions, but the amount passed was of such small proportions that on long continued standing no precipitate would settle.

Speaking generally, no perceptible difference could be observed between the papers under test and those with which they were compared in their behaviour towards a solution containing one of the most difficult substances to filter met with in analytical practice. The amount of the oxides of tin and antimony so passed could be regarded as of no practical importance.

A Choice of Filter Paper for Several Purposes

IT is surprising to find that a number of really intelligent chemists use filter paper which is totally unsuitable to the job, chiefly because they will not take the trouble to read the manufacturer's catalogue which explains in detail that one particular paper should be used for a particular purpose. This important statement has been made by J. Barcham Green and Son, who supply a wide range of filter papers for analytical and general laboratory use.

Green's 401 is low in price and is a really reliable machine-made paper for routine work. The ash content of an 11 cm. circle is 0.0027 gm. Green's 795 is hand-made, all rag, the ash content of an 11 cm. circle being only 0.0018 gm. This paper is free from pinholes, strong when wet, and suitable for important normal analysis. Green's 797 is another all rag, hand-made paper; it filters at a good speed and is especially suitable for thick liquids in large quantities, such as oils and syrups. This paper is extra strong and the ash content of an 11 cm. circle is 0.0033 gm. Green's 702 is a slow, thin filter paper for difficult precipitates, such as barium sulphate, and it is capable of withstanding a vacuum. In all cases it gives a clear filtrate. Here the ash of an 11 cm. circle is only 0.0035 gm. It is invaluable for highly scientific qualitative analysis. Green's 704 is made for speedy filtration; it is a thin, very pure paper, which is strong when wet. The ash content of an 11 cm. circle is only 0.0020 gm. Green's 802 is a "twice washed," all rag, hand-made, ashless paper at an exceptionally low price. It is used by chemists who want a tip-top paper but do not want to pay a fancy price for it. In this case the ash content of an 11 cm. circle is 0.00022 gm. All of these papers are packed in cartons of 100 circles, which keep the paper clean and avoid separate lids which can be lost. Free samples can be obtained direct from the makers, who have been established 125 years.

Four Main Types of Filter Papers

THE ideal filter paper would combine absence of ash, rapidity of filtration, retentiveness to fine precipitates, and strength when wet, but such paper does not really exist, and manufacturers have therefore to provide a range of grades to cover all requirements.

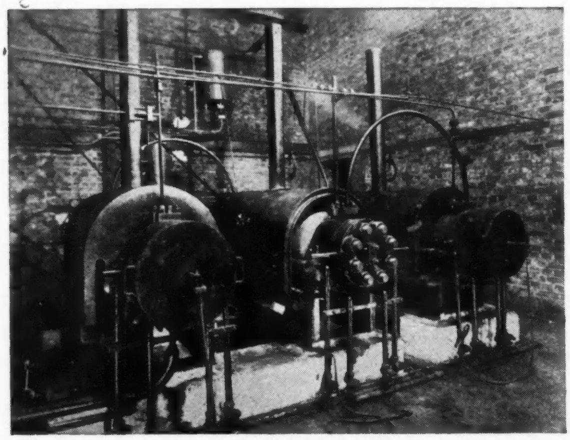
According to W. and R. Balston, Ltd., there are four main types of filter paper: (1) Commercial, as used for larger scale filtrations, in breweries, oil refineries, etc. (2) Higher grade but unwashed, of greater chemical purity, with ash under 0.3 per cent. but yet not suitable for delicate work (largely used in schools and colleges). (3) Acid-washed grades, which are divided into (a) hydrochloric acid washed only and (b) washed with hydrofluoric acid in addition (the latter being best fitted for the most delicate work as the ash has been reduced to 0.015 per cent. or less). (4) Hardened or toughened papers—also of low ash content where necessary—which will not pulp up when subjected to severe washing, and which can actually be used again several times when the precipitate or sediment does not require to be incinerated while attached to the paper. Type 4 can be made to possess a very high degree of purity, and are much in demand for filtration of sera and other biological products. All the four grades can be purchased in a range of speeds varying from slow and retentive to very rapid.

High Pressure Hydrogenation Plant

A Discussion on Mechanical Difficulties Experienced in Operation

AN account of some mechanical difficulties experienced in the development and operation of experimental plant for the hydrogenation of coal and tar at the Fuel Research Station, Greenwich, was given in a joint paper by Mr. A. T. Barber, B.Sc. (Eng.), and Mr. A. H. Taylor, B.Sc. (Eng.), read before the Institute of Mechanical Engineers on November 16. The scope of the paper was chiefly confined to high-pressure reaction vessels and their associated pipes and fittings.

In the hydrogenation process heavy liquid hydrocarbons, or solid hydrocarbons, such as coal, are subjected to the action of hydrogen, whereby a portion of the hydrogen enters into chemical combination, resulting in the formation of some lighter liquid hydrocarbons together with a certain amount of gas, and, when compounds containing oxygen are treated, water. The extent and speed of the reaction and the efficiency of the process are governed by the temperature and pressure at which it is carried out, and are also influenced by the presence of certain catalysts. Most of the experimental



Front View of Bergius Converters.

work has been carried out under a pressure of about 3,000 lb. per sq. in. and at temperatures ranging from 800° to 950° F., though pressures up to 6,000 lb. per sq. in. have been used.

As originally carried out the process for the continuous hydrogenation of coal necessitates the preliminary grinding of the coal so that it will pass through a sieve having, say, 20 meshes to the inch, and then incorporating it with about 40 per cent. by weight of tar to form a stiff paste. After the process has started, a heavy liquid residue from the product may be used as the vehicle for the paste mixture. The small quantity of catalyst required is also added at the same time. The mixture is then fed into a paste pump whence it is forced into the reaction vessel maintained at the working pressure and temperature. The paste pump and connections are usually steam-heated to assist the flow of the material. Hydrogen delivered from a multistage compressor is fed into the reaction vessel at the same time and during their passage through the vessel the ingredients are kept well mixed by means of a rotating stirrer.

Products of the Reaction

The product leaving the reaction vessel is a heterogeneous mixture of solids, liquids and gases. It is passed through water-cooled coils to a separator maintained at a pressure of 900 lb. per sq. in. The gases pass off at this point to a scrubbing tower where the light spirit is washed out with gas oil, and the stripped residual gases containing about 65 per cent. of hydrogen may be returned to the compressor for recirculation. The remainder of the product, after being further freed at atmospheric pressure from dissolved gases, is then passed through a centrifugal separator to separate the true liquid product from solid residues and water. The resulting liquid resembles a somewhat viscid tar.

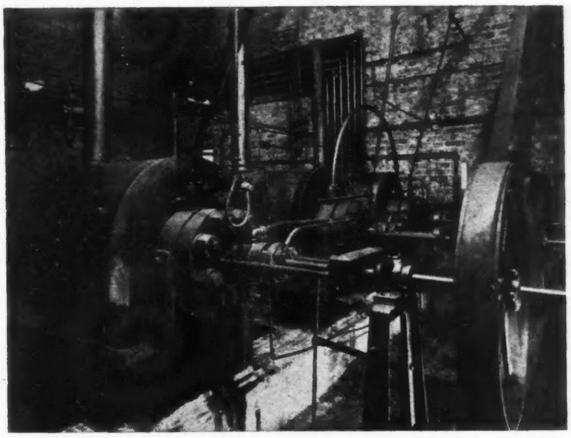
The crude product contains about 10 per cent. of water and 50 per cent. of oil boiling below 680° F., of which 10 per cent. is spirit boiling below 392° F.

Some hydrogenation of tar has been carried out in the coal plant in a similar manner, but the process, as now operated, consists of pumping hydrogen and tar into a vessel having a reaction space filled with a suitable catalyst. The resultant product is drawn off and dealt with in the same way as the coal product, but the process is simplified by the absence of solid material. The liquid product resulting from the hydrogenation of low temperature tar or tar oils is, of course, much lighter than that from coal and contains from 40 to 70 per cent. by weight of spirit boiling below 392° F.

In 1926 a plant for continuous operation, having a capacity of 1 ton of coal per 24 hours, was installed as a result of the interest in the British Bergius Syndicate shown by the Department of Scientific and Industrial Research.

Failure of Mild Steel Converters

When this plant had been working for a total of 463 hours it was necessary to take the first converter out of service. It had been used for some time for hydrogenating tar, and continual leaks had been experienced at an end cover joint. The converter was removed and the seatings of body and spigot were skimmed in the lathe. Both seatings showed slight pitting after skimming, but as this did not look serious the converter was re-installed and a tight joint made. After only twelve hours, however, serious leakage took place and on examination a deep groove was found across the seating. Another cut was taken off the seating on the converter body in the lathe. Considerable pitting was exposed, which



Rear View of Bergius Converters.

increased with further removal of metal. On further examination, numerous black streaks were found running longitudinally for several inches at the faulty end of the converter, the ends of which showed as pits in the seating. It appeared as if the vessel had been forged from a badly piped ingot, as no serious attack by hydrogen could have occurred at this point.

After about 700 hours' working, converter No. 2 suddenly ruptured while hydrogenating tar under normal operating conditions. The rupture was accompanied by a loud roar as the contents escaped and caught fire, splashing molten material about the room. When the converter was cooled and dismantled, examination showed that a long crack had opened out along the top centre inside the converter for a length of 28 inches, the greatest width of the crack being ⅜ inch. On the outside was a long shallow depression adjacent to the middle portion of the crack inside. The actual length of the opening on the outside through which the contents discharged was probably about 3/16 inch only, and it closed up

completely on cooling. This converter was afterwards cut in halves at right-angles to its axis, and sections were parted off for further examination. Many minor cracks were then seen all round, radiating outwards; they were rather more numerous in the upper than in the lower half. It was noted during cutting these sections that the inner third of the wall was hard and brittle, while the outer portion left the tool like normal mild steel.

Apart from the action of hydrogen in decarburising the steel and penetrating the crystal boundaries, the stress of 6 tons per sq. in. is high for a mild steel operating at 850 to 900° F. The "time yield" stress at this temperature is well known to be only about 5 tons per sq. in. The failure of these vessels would appear to be the result of hydrogen reducing the cohesion of the crystals at the inner surface, with subsequent separation of the crystals under the stress. The initial stress, already high, was increased as the effective thickness of the walls was reduced. The effect of both the hydrogen attack and the stress was therefore cumulative and the outer ring finally failed in tension.

Some time before the failure of any of the converters, inquiries had been made in this country for replacements made of a more suitable steel and in 1928 three converters were obtained from Hadfield's, of Sheffield, in their "Era HR" steel, a heat-resisting steel which is also resistant to the action of hydrogen. The percentage composition is: carbon, 0.2; chromium, 22.0; nickel, 7.0; tungsten, 4.0; silicon, 1.75. At the makers' suggestion these were made as castings instead of forgings, as it was thought that it might not be possible to avoid small forging cracks. The oldest of these alloy steel converters has been in use for about 600 working hours and has so far shown no sign of deterioration.

Points from the Discussion

Professor C. H. LANDER remarked that a great deal of the work outlined in the paper was carried out during the time he was Director of Fuel Research and the presentation of the paper was particularly opportune as during the week the Melchett Medal had been presented to Dr. Bergius by the Institute of Fuel for his discovery of the possibility of getting petrol from coal. When the experimental work was carried out at the Fuel Research station the bombs or converters only lasted for 1,000 hours, which was ridiculous from the commercial point of view. Later, it became apparent to the English and German groups working on the problem that the reaction which was occurring inside the bomb was an exothermic reaction—a heat-giving reaction—so that, provided bombs could be made of a sufficiently large size, large enough to enable lagging to be put inside between the actual pressure chamber and the wall of the bomb and so keep the wall of the bomb cool, the life would be considerably extended. That, indeed, had enabled large-scale operations to be successful.

Speaking generally, Dr. Lander said that although he did not wish to raise a scare, because there was no need for it, it was nevertheless the fact that in ordinary practice with the introduction of high pressures in the presence of steam and high temperatures we are beginning to approach some of the conditions which existed in the experimental work described in the paper. Under these conditions there was the possibility of the dissociation of water taking place giving rise to corrosion. At the same time as oxygen was absorbed by water, causing iron oxide to form, hydrogen would be given off and the effects of hydrogen in these circumstances had been shown in the paper. Although this was a warning that had been given before it was well to recognise that this state of affairs was beginning to be approached in ordinary engineering appliances in some cases.

Hydrogen Embrittlement

Professor B. P. HAIGH said one almost regretted that the authors' experiments regarding embrittlement had been cut short before we had learned all there was to be learned about it and all that others working in the same field would have liked to know. As to whether the cracking reported by the authors was due to hydrogen embrittlement or to some other cause, he was tempted to suggest that it was due to creep complicated by the stress gradient. If creep did exist, it was proceeding under extraordinarily abnormal conditions, because, while the inside of the tube was subject to very great stress the outside was subjected to very little. The stress at the outside had been shown to be only ½ ton per sq. inch, but the stress inside was very considerable and that high stress at high temperature would be likely to produce creep in mild steel. If that were so it was to be expected that the inside of the tube would become disintegrated, as the authors had shown, and this creep would proceed to a greater extent more locally than in an ordinary creep test. Although he was inclined to think that hydrogen got right through the metal yet the fact that the fissures did not, indicated creep conditions rather than hydrogen activity.

Dr. JAMES BURNS pointed out that corrosion of high pressure plant is caused both by hydrogen and by sulphur, and it had been interesting to note the relative effect of corrosion by hydrogen and by sulphur. He had made a study of two reaction vessels, one of which was subjected to the action of hydrogen at 200 atmospheres and a working temperature of 200° C., whilst the other was subjected to the action of hydrogen and sulphur. Both reaction vessels were in operation for 20,000 hours, *i.e.*, roughly for three years, and neither of them failed but after a time they were examined both by chemical analysis and tensile strength experiments. The reaction vessel subjected to hydrogen alone showed, on chemical analysis, that the carbon had been completely removed from the inside of the vessel and that there was a gradual gradation from the inside to the outside of the vessel until at the outside all the original carbon was still there.

Drop in Tensile Strength

The tensile strength had dropped very considerably from the outside to the inside. In the case of the reaction vessel which had been subjected to the action of hydrogen and sulphur it was found to be practically identical with one of the instances illustrated by the authors. There was a thick layer of iron sulphide on the inside but the interesting point was that the carbon content of the steel just inside this layer was practically the same as in the original steel. In other words, the sulphur had had a protecting effect on the steel and had given it a much longer life than would otherwise have been the case.

Mr. HAMILTON MARTIN, speaking with regard to the brittleness of nickel steel and the possibility of stopping the action of hydrogen on steel, referred to work that has been carried out on the Continent. It had been recognised there, he said, that nickel at these high temperatures has a brittleness effect and a material containing chromium and aluminium had been introduced for these converters and vessels. This material was of a ferritic pearlitic structure and had very great strength at high temperatures, it had low creep and was entirely non-scaling. In itself it was practically entirely free from sulphur, containing only 0.005 or 0.003 per cent. and it was not attacked by sulphur. With the use of this material it had been found that aluminium oxide layers were formed which adhered very tightly to the surface and the sulphur could not get to the material, so that there was none of that breaking up which had been shown by the authors.

Reactive Inertia to High Pressure

Moreover, there was no effect from the action of the hydrogen and its reactive inertia to high pressures was extraordinary. He understood that 25 hydrogenation converters constructed of this material had been made, as well as heat exchangers, for the synthetic ammonia process, the methanol process and other high-pressure processes, and that they were standing up well to their work. One such plant was working at 300 atmospheres and about 500° C. and another at 1,000 atmospheres and about 600° C. The great point was that there was no nickel. The aluminium oxide protected the metal against oxygen getting in or sulphur gases or hydrogen, and he heard this material was doing well on the Continent. Further, with large vessels heated on the outside consisting of alloy steels containing, for example, molybdenum, the outside surfaces were alumitised, giving a layer of aluminium and steel which had been found very effective.

Mr. W. B. SHANNON, speaking of the seizure of bolts in these plants, asked the authors if they had considered using ground threads. As to the influence of hydrogen on welding, he inquired whether electric welding behaved in the same manner as oxy-acetylene welding in the presence of hydrogen. It was well known what had happened to bolts recommended by the British Standards Institution. These bolts were of no use in steam installations and showed just the same tendency to embrittlement as steels with higher

percentages of nickel than were indicated in the paper. The present tendency appeared to be to employ bolts without nickel but having chromium and molybdenum.

Mr. R. W. ALLEN said he had been informed by one of the leading metallurgists of the day that if an ordinary 28-32 tons carbon steel was heat-treated and quenched in oil it possessed the virtues of ordinary Siemens-Martin steel without any danger. He wondered if converters made of Siemens-Martin steel were heat-treated and oil-quenched there would be the same difficulty with regard to hydrogen attack.

Mr. A. H. TAYLOR, replying to the discussion and dealing with the question of creep, mentioned by Professor Haigh, said that one-third of the thickness of the wall had been shown to be penetrated by hydrogen when the sections were cut in the lathe. The inner third came off in a very brittle manner and in very small pieces, but after that the cuttings became more and more normal until at the outside the cuttings came off in quite the normal manner with mild steel. Thus, the embrittlement was much greater on the inside and suggested hydrogen attack rather than creep in the ordinary way. As regards the point made by Dr. Burns in relation to corrosion by hydrogen and sulphur, he said that undoubtedly the scale does have a protective effect, but under the conditions of these experiments the scale was liable to crack and the hydrogen to get in.

Commenting on what Mr. Hamilton Martin had said, he remarked that nothing had yet been done at the Fuel Research Station with aluminium steels. As a matter of fact, they had been rather afraid of aluminium partly because on one occasion they put an aluminium tube inside the reaction chamber to protect the thermocouple tube and the aluminium tube had been corroded and completely eaten away. Attempts had been made to overcome the seizure of bolts by coating the threads with dry graphite or a paste of water and graphite. Seizure was not very serious, but recently there had been trouble again and Vibrac steel bolts and nuts had been used, and also mild steel nuts. He agreed that ground threads might probably overcome the difficulty; as a matter of fact, it had been found that if great care was taken in forming the threads and the work was done more or less perfectly, trouble seldom occurred. Unfortunately, some of the threads had been made in rather a hurry and were not quite so good as they might have been.

The PRESIDENT (Mr. Charles Day), in proposing a vote of thanks to the authors, said the paper appealed to him because it showed how work on a small scale could lead to commercial operation. As regards the injury which hydrogen did to the steel he wondered whether we shall see something akin to that which had happened in the case of nitrogen. Years ago nitrogen had a very bad effect on steel with the result that vessels which contained ammonia and nitrogen, and were heated, became brittle. Nitrogen was a real nuisance with steel, but such had been the developments since that, instead of being objectionable, nitrogen was now one of the greatest blessings in improving the quality of steel and giving a very hard surface. Therefore, he wondered whether some similar development would take place so that hydrogen, instead of being a curse would become a blessing, due to a change in the composition of steel which would change the nature of the action of hydrogen upon it.

Secrets Offered to Imperial Chemical Industries

Woolwich Arsenal Clerk Sentenced

WILLIAM BURGES, 59, a computer at Woolwich Arsenal, was sentenced on January 17 at the Central Criminal Court to 12 months' imprisonment in the second division on pleading guilty to a charge of communicating to an unauthorised person secret papers calculated to be useful to an enemy. The prosecution was under the Official Secrets Act of 1911 and 1920. Burges, who lives in Macoma Road, Plumstead, was a second-grade computer, and the indictment, which contained five counts, charged him with obtaining "for a purpose prejudicial to the safety or interests of the State certain sketches, documents and information calculated to be useful to an enemy," and communicating and attempting to communicate them to an unauthorised person.

Mr. Eustace Fulton, prosecuting, said that Burges had been employed at Woolwich Arsenal for some 11 years. Imperial Chemical Industries, Ltd., was in close touch with Woolwich Arsenal, and early in November there was certain information that the company wanted from the War Office. Some was given, but certain other information was refused, and this refusal was recorded in a minute. Burges would have access to that minute. When the information was refused, Imperial Chemical Industries, Ltd., received a letter addressed to the managing director.

Mr. Fulton said that it was not desirable that he should read the whole of it, but it pointed out that the writer was in a position to obtain the information relating to foreign contracts which could not be supplied, and asked them, if they wished to pursue the matter further, to put a personal advertisement in the "Daily Mail" in the name of George Vincent. The company immediately communicated with the War Office and everything done from that time was done under the direction of the War Office. The company inserted an advertisement, and on December 4 received a further letter, in which the writer said he hoped to see them on the following day. It was arranged that an experienced inspector of police should be present at the company's office when the accused arrived.

Burges had three documents with him, and it was grossly improper for them to be communicated to anyone. The managing director of the company told Burges he would require some time to investigate the documents, and suggested they should be left with him in order that he might put his own experts on them. A sum of £100 was suggested as the price for the documents, and later Burges wrote suggesting that there should be a payment on account of £25 in small notes. An appointment having been made in Parliament Square on December 8 by way of an advertisement, Burges was met by police officers and arrested.

Mr. Justice Atkinson asked Captain Phillips, of Woolwich Arsenal, if he could say what was the value of certain of the documents to, say, a foreign country. Captain Phillips replied that they might enable them to make better war material.

Mr. Justice Atkinson.—Does your department take a very serious view of this or just a serious view.—They take a serious view of it.

Mr. Norman Birkett, K.C., addressing the Judge in mitigation, said Burges recognised now how grave any offence of this nature must be, whatever objective was in his mind at the time. He desired that it should be publicly expressed that his contrition was deep, sincere and profound. By his act he had completely ruined himself. He had one son and five daughters. The folly which he had committed was done with the sole desire to assist one of his children. Burges had rendered great service to his country. He was the son of a doctor, and, after spending a few years in medical instruction, joined the Army as a private in 1899 and remained in the Army until 1921. He distinguished himself on the Western front during the great war and was promoted to captain. He commuted his pension for £1,500 and put his capital into a poultry farm, losing every penny of it. At the Arsenal his pay at the lowest was £192 a year and at the highest £273 a year.

His only ambition was to give his children every opportunity in life. In 1934 one of his daughters, aged 19, obtained a scholarship, and he found himself liable to pay £7 a month, or, if the girl did not take up the scholarship, which she had accepted, to pay £55. Faced with having to get something like £80, and with no pay until January, the request of Imperial Chemical Industries, Ltd., came before him.

Mr. Justice Atkinson, in passing sentence, said it was a satisfaction to him that neither the prosecution nor the Government department concerned regarded it as a case of extreme gravity. "I am certain," the Judge continued, "that what you did was not done with any desire to prejudice the interests of your country, and I am ready to believe it never entered your head that what you were doing was, in fact, prejudicial to your country's interest."

Notes and Reports from the Societies

Society of Chemical Industry

Birmingham Section : Metals in the Food Industry

A PAPER of interest to all concerned with the manufacture of food was read by Mr. N. D. Sylvester, M.Sc., A.I.C., at a meeting of the Birmingham and Midland Section of the Society of Chemical Industry, on January 21.

"The food chemist," said Mr. Sylvester, "is as jealous of the purity of his product as the chemical manufacturer is of the purity of his fine chemicals, and one of his primary considerations must be the suitability or otherwise of the metals at his disposal." In considering the suitability of a metal for a food process there were three things to be considered. The first was the effect of the metal on the food and the amount of metallic contamination, the second was the effect of the food on the metal, and the third was the effect of washing and cleansing solutions on the metal.

The action of washing and cleansing substances on the plant was of great importance and was often more serious than the action of the food. The metallic contamination of the food was a matter of primary importance, and so far as possible it should be reduced to a minimum. The question of toxicity of the metal must be considered as the presence of the slightest traces of a metal such as lead could not be allowed, and no metal or enamel containing arsenic or antimony could be used in the food industry. The recent development of cadmium platings had made a further addition to the list of prohibited metals. Quoting a number of examples of foods affected by different metals, Mr. Sylvester said it was interesting to note that the presence of 1 part of copper in 40 million parts of butter had recently been shown to have a marked effect on the keeping properties of the butter. The presence of copper in milk was one of the causes of the development of tallowy flavours, and iron showed a similar but less marked influence.

Among the more important factors influencing the extent of the corrosion of metals by foods were temperature, time of contact, presence or absence of air, formation of protective films derived either from the food or from the metal—which might protect the food from contamination or the metal from further corrosion—and, lastly, the cleanliness of the plant. On this question it was to be remembered that operatives take a pride in keeping plant spotlessly clean when the results of their labours are readily apparent; therefore it was a definite advantage to use a constructional metal which would look clean when it was clean. Some of the modern stainless alloys were admirable in this respect.

Judged by modern standards copper was not a suitable metal for use in the food industry, but in the milk industry, and the food industry as a whole, tinned copper had found fairly extensive application. Chromium plating had found an appreciable use in the food industry, but, if the quality could be improved to the present reliability of, for example, nickel plating, it should have many more applications. The use of silver, in view of the fall in price, had increased, and plant lined with silver sheet was particularly resistant to acetic acid vapours. Mr. Sylvester dealt at some length with nickel and its alloys, mentioning especially Inco chrome nickel, or Inconel. Such metal appeared to be ideal for food processing in general, and where cleanliness and freedom from metallic contamination were matters of greatest importance, as in mayonnaise manufacture, and in the preparation of fruit essences. Aluminium was suitable for use with acid foodstuffs, such as fruit, but it was necessary to observe the greatest care as regards cleanliness. The numerous aluminium alloys were mostly constructional materials and found no appreciable use in the food industry, though Birmabright, a corrosion-resisting alloy containing magnesium, was suitable for use in all cases where aluminium was suitable and its performance was generally superior. It should be suitable for almost any conditions ordinarily met with in the food industries.

Glasgow Section : Two Papers on Glass

A JOINT meeting of the Glasgow sections of the Society of Chemical Industry and the Institute of Chemistry was held on January 18. Mr. T. Cockburn was in the chair and referred to the loss both societies had sustained by the death of Mr. R. R. Tatlock, of Tatlock and Thomson, analytical chemists. Papers were read by Dr. Hampton and Mr. J. Boyd, of Chance Brothers and Co., Ltd.

Dr. Hampton dealt with "Certain Physical Properties of Glass" and said that formerly it was thought that there was little relation between the chemical composition and the properties of a glass. Owing to the use of impure raw materials chemical control, as we know it to-day, was impossible. Dr. Hampton divided the physical properties of glass into four classes and dealt chiefly with properties which, at constant temperature were not strictly controllable and whose measurement was therefore subject to substantial and inevitable variation. Tensile strength was a property found to vary to a considerable extent among specimens taken from the same batch of glass. No satisfactory explanation of this had yet been given, but it was known that the tensile strength of glass in thin threads was greater than in larger sizes.

In the second portion of his paper, Dr. Hampton considered heat absorbing glasses. He said that what was required in a heat absorbing glass for glazing purposes was as high a light transmission as possible with the lowest heat transmission. It was natural to assume that the glass having the highest ratio—light transmitted/heat transmitted—would be ideal for the purpose. This was not a strictly correct method of comparing glasses and Dr. Hampton said that it was better to prepare a complete spectrophotometric curve of a particular glass and then to calculate its transmissive properties for any other thickness. In conclusion, the effect of using ordinary glass and Chance's "calorex" for roofing purposes was explained.

Mr. Boyd then read a paper entitled "Glass Silk and Heat and Sound Insulation." He described the properties of glass silk and showed that it was ideal for heat insulation and had also been found excellent for sound insulation.

Chemical Engineering Group

Fillers in Bituminous Road Construction

THE employment of fillers in bituminous road construction was the subject of a paper by Professor Dr.-Ing. E. Neumann, of the Technical High School, Stuttgart, read at a joint meeting of the Chemical Engineering Group and the Road and Building Materials Group, on January 16. Professor Neumann was unable to attend the meeting, but his paper was presented by Mr. F. M. Potter.

Professor Neumann's paper described the influence upon bituminous binders of mineral aggregates in the form of finely ground powders, an increase in hardness, a property long known to chemists. The papers of Clifford Richardson, he said, had served to draw the attention of those concerned in the employment of bituminous materials for road construction to many aspects of the problems arising therefrom, while an interesting survey of the subject is found in Marcusson's book "Die natürlichen und künstlichen Asphale." Regarding the value of fillers not only must their fineness as determined by sieving, flotation, or air elutriation be known, but also their particle structure, whether rounded, fibrous, lamellar, or cubical, and its texture which may be amorphous or crystalline.

According to Dr. Herrmann's "Tätigkeitsbericht," the criterion for a serviceable filler is the presence of mixed particle sizes, from the finest to the coarsest grades, in the material passing the 4,900 sieve. The compressibility of the filler shows whether it is amorphous or crystalline, amorphous fillers being more compressible than crystalline, relative to the shaken condition.

Investigations have been undertaken to determine how far the amount of bitumen required depends on the type and surface of the filler, it being found that the minimum amount of bitumen required to give a plastic mixture increased with the surface of the filler. These experiments did not show wide variations in the values of the maximum tensile strength but the quantity of bitumen required varied with the filler, the difference being particularly noticeable between basalt and limestone. Experience in the construction of bituminous roads has shown that the behaviour of the mineral aggregate towards the binder must play an important rôle, different types of aggregate frequently behaving differ-

ently towards bitumen, this being particularly noticeable in aggregate mixtures which contained fillers.

At the Highways Department of the Techn. Hochschule, Stuttgart (V.A.), the reliable method of colorimetric estimation employing a colorimeter manufactured by Leitz was used. Basalt, kaolin, porphyry, granite, quartz, limestone, slate, and ignited Trinidad bitumen filler served as types of aggregate, and Mexican, Californian, Rumanian, and pure Trinidad bitumens as binders. The aggregates were fine powders and, as fine mineral powders are used as fillers in the construction of asphalt roads, this research tends to explain their behaviour in road carpets.

The cohesive property of bitumen, which is determined by the ring and ball softening point test, is of special importance in road construction. This property is changed by the addition of a filler, the softening point rising, and thus improving from a road construction point of view, the cohesive properties of the binder. The improvement depends on various influences such as the increasing cohesion of tar and bitumen brought about by the addition of fillers and the increase in viscosity. Adsorption and absorption have considerable influence on the stiffening, a comparison of the figures for bauxite and for limestone dust showing that the effect is greater than that of fineness of the filler. The colloidal nature of the binder is also of importance, for active fillers show a strong attraction towards the disperse phase, while the oily phase is only weakly adsorbed.

The bituminous mortar, consisting of filler and bitumen, forms the most important component in asphalt and tar carpets designated as sand asphalt, asphaltic and tar concretes, etc. The investigation has shown that the filler must not only lower the voids in the aggregate to the desired figure, but, still more important, must in combination with the bitumen act as the matrix or mortar which binds together the aggregate into a resistant carpet. The matrix can only fill this rôle satisfactorily if there is a definite ratio of filler to bitumen, this ratio being mainly dependent upon the adsorptive power and fineness of the filler.

In the course of the discussion some disappointment was expressed by one or two speakers because the experimental work described in the paper was not correlated with practical results.

Royal Society of Arts

Lectures on Factory Accidents

A SERIES of three lectures on factory accidents, illustrated by lantern slides, will be given under the Shaw Trust at the Royal Society of Arts on February 25, March 4 and March 11. In the first lecture, on "The Prevalence, Distribution and Causation of Factory Accidents," Mr. D. R. Wilson, Chief Inspector of Factories, will deal with the definition of factory accidents, their frequency and number compared with those in other occupations, their effect on production, general factors in accident causation and general methods of prevention. On March 4, Mr. G. Stevenson Taylor, deputy Chief Inspector, speaking on "The Principal Causes," will deal with personal and impersonal factors, machinery, transport, electricity, explosions, fires, gassing, molten metal and corrosive substances, collisions with objects, handling of goods and the development of factory accident legislation. In the final lecture, on March 11, on "Measures for Prevention," Mr. Leonard Ward will discuss transmission machinery, lifting appliances, hand-operated tools, falls of persons and materials, eye injuries, selection of workers, educative measures, lighting and the Home Office Industrial Museum.

The chair will be taken by Sir John Gilmour, Home Secretary, Mr. J. R. Clynes, former Home Secretary, and Sir Kenneth Lee, chairman of Tootal, Broadhurst, Lee Co., Ltd.

Society of Public Analysts

THE next meeting of the Society of Public Analysts will be held on Wednesday, February 6, at the Rooms of the Chemical Society, Burlington House, London, at 8 p.m., when the following papers will be read:—"The Chemical Examination of Furs in Relation to Dermatitis. Part V. The Action of Acid on Bandrowski's Base" (H. E. Cox, D.Sc., Ph.D., F.I.C., and J. U. Lewin, B.Sc., F.I.C.); "The Use of Infra-Red Rays for Distinguishing between Inks and Pigments" (C. Ainsworth Mitchell, M.A., D.Sc., F.I.C.); "Vitamin Potency and Associated Characteristics of Cod-Liver Oil" (R. S. Morgan and H. Pritchard); "Commercial Ground Almonds and their Adulteration" (G. N. Grinling, F.I.C.).

British Association of Chemists

THE conversion of carbon dioxide and water into sugar was the subject of a lecture which Professor E. C. C. Baly delivered at the Derby Technical College on January 17. This lecture, whilst arranged by the Notts and Derby Section of the B.A.C., was under the auspices of the Derby Chemists Joint Committee. An enthusiastic audience of 60 was present and Mr. J. F. Briggs, F.I.C., of British Celanese, Ltd., presided.

Mineralogical Society

A MEETING of the Mineralogical Society was held in the Rooms of the Geological Society of London, Burlington House, Piccadilly, on January 24, when Mr. H. H. Hey described simple apparatus for the determination of carbon dioxide by collecting the gas in baryta solution, and subsequently filtering and washing the barium carbonate produced, with complete exclusion of atmospheric carbon dioxide.

Personal Notes

MR. JOHN BROOKS, formerly managing editor of the technical journals and publications of John Heywood, Ltd., Manchester, has been appointed editor of "Silk and Rayon."

MR. THORP WHITAKER, of Bradford, Yorkshire, a director of the Bradford Dyers' Association, and ex-president of the Society of Dyers and Colourists, left £15,741.

MR. ARTHUR GILLIAT, who had been prominently associated with the chemical trade for over sixty years, and whose death was reported in THE CHEMICAL AGE last week, was buried at St. Matthews Church, Chapel Allerton, on January 17.

DR. E. F. ARMSTRONG, who is a director of Herbert Green and Co., Ltd., is visiting New York in connection with the company's constructional work now being carried out at its refinery at East Halton, Lincs. Some 160 men are at present employed. This number will shortly be increased to at least 400.

MR. K. D. GUHA, a Bengali chemist, who recently graduated from Liverpool University, has been appointed technical adviser on industries to the Ceylon Government. Mr. Guha carried on research in industrial chemistry under Professor T. P. Hilditch at Liverpool. He was awarded a scholarship by the Empire Marketing Board, and after taking his M.Sc. in 1931 he acquired further industrial experience in Germany.

SIR G. CHRISTOPHER CLAYTON, M.P. for Wirral since 1931, and M.P. for Widnes from 1922 to 1929, has announced his intention not to stand as a candidate at the next General Election. Sir Christopher is a director of Imperial Chemical Industries, Ltd. In 1932 he was elected chairman of the Liverpool Gas Co. in succession to the late Sir Henry Wade Deacon, having been a director of the company since 1922.

MR. BIRKETT WYLAM, Chief Inspector for Scotland under the Alkali, etc., Works Regulation Act, has been appointed expert adviser to Sir Arthur Rose, in connection with proposals as to the possibility of establishing a regional gas grid within the industrial area of Lanarkshire and Renfrewshire. Mr. Wylam's address, while engaged on this investigation, will be the Commissioner's temporary office at 25 Palmerston Place, Edinburgh.

MR. W. W. WATT, formerly managing director and chairman of Ogston and Tennant, Ltd., has been appointed vice-chairman of the Port Sunlight management committee of Lever Brothers, Ltd. The whole of Mr. Watt's business life has been spent in the soap industry, and he joined Ogston and Tennant as a junior in 1904, when their works were situated at St. Rollox, Glasgow. Later he became managing director and chairman of the company's interests at Renfrew and Aberdeen. Since the firm became associated with Lever Brothers, Ltd., in 1911, he has been in constant contact with the Port Sunlight company.

Alleged Libel

Advertisement in a Trade Periodical

A SETTLEMENT was arrived at in the King's Bench Division on January 17, of a libel action by the Poppe Rubber and Tyre Co., Ltd., of Twickenham, against the "India Rubber Journal." Plaintiffs claimed that they were the manufacturers, under a secret process, of "Poppe rings," used for sealing receptacles containing foodstuffs and liquids. They complained that the "India Rubber Journal" published an advertisement which stated that the original "Poppe rings" were made solely by a German firm and could only be obtained from a certain company in Upper East Smithfield, London.

At the conclusion of the plaintiff's case, Sir Patrick Hastings, K.C., said they had always been willing to end the proceedings when there was a full explanation forthcoming from the defendants. They did not wish to make a penny from the action. The paper had now made it perfectly plain that they cast no aspersion on the Poppe Company.

Mr. T. J. O'Connor, K.C., said the defendants wished fully and frankly to express their regret that the advertisement should have been published and they would indemnify the plaintiffs in regard to the costs of the action.

Lord Hewart acquiesced in the settlement.

Chemical Workers' Wages

Statement by the Manufacturers' Asscoiation

AFTER meetings of the executive of the Chemical Workers' Union in London on January 19 and 20 it was decided to accept a resolution of the London group and issue ballot papers to all members of the union in all factories—whether London or provincial—to ascertain whether they are prepared to withdraw their labour on a date to be fixed. The object is to secure operation of the terms of a new agreement submitted to employers on September 1 last, on which discussion was then refused. In the event of a stoppage some 12,000 to 15,000 workers would be affected.

On January 13 delegates of the union, representing 40 drug and fine chemical establishments, asked the executive to consider a strike ballot after the refusal of employers to entertain a demand for a minimum wage of £4 a week for adult employees—representing 10s. a week increase—with corresponding increases for other grades, and a 40-hour week.

It was pointed out on January 19 in a statement by the Drug and Fine Chemical Manufacturers' Association that wages and conditions in the trade are regulated by a national agreement between the association and the joint trade union committee for the drug and fine chemical trade, which represents four trade unions, all affiliated to the Trades Union Congress. The statement added: "The Chemical Workers' Union is not recognised by the T.U.C. or the employers' organisation, and does not represent the workers in the industry, the joint trade union committee being responsible for negotiations with the employers."

Powder Explosion at Ardeer

Two Men Dead : Two Men Injured

ONE man was killed and three others were seriously injured in an explosion which occurred at the Ardeer factory of Imperial Chemical Industries, Ltd., near Stevenston, on the Ayrshire coast, on January 18. The dead men are Michael Fitzpatrick, aged 26, a laboratory assistant, who resided in Springvale Street, Saltcoats, and David Telford, 23, laboratory assistant, of Stevenston. The injured are Elwyn Jones, 23, chemist, of Saltcoats, and Robert Hargraves, 24, chemist, of Saltcoats. Both of the injured men are suffering from injuries to the body and face caused by burning.

The explosion occurred in the black powder experimental laboratory, where the two chemists and their assistants were engaged in special work connected with explosives. It is not yet known how the explosion occurred, but all the men were very severely burned. A local doctor, with the assistance of the factory's first-aid squad, dressed the injuries temporarily while arrangements were made for a special train to take the men to Glasgow. At the Glasgow Western Infirmary all of them were immediately operated on. It was at once seen that Fitzpatrick was in a critical condition, and he died shortly after admission. According to an official statement no important material damage was done by the explosion.

Normally, there are six men at work in the hut which was involved, but when the explosion occurred two of them were absent on duties elsewhere. The Ardeer works cover a great extent of ground, and the various processes are carried on in small buildings, of which there are over 1,000, carefully isolated from each other and each surrounded by high banks of sand. A witness of the accident said his attention was attracted to the hut by the sound of a dull explosion. It seemed to do extensive damage to the roof and walls, but it was difficult to see because of the volume of smoke which followed. The flames shot high in the air, and in a few moments what there was to burn about these huts burned fiercely. Workers in adjoining parts of the works ran to the spot. Detachments of the works fire brigade were mobilised, but in spite of their efforts the hut was destroyed.

Asphalt Road Construction

New Standard Specifications

THE British Standards Institution published on January 21 a series of new standard specifications covering the whole field of asphalt road construction. They represent the findings of a joint committee consisting of municipal and county engineers, technical and professional representatives of the Government Departments, and of societies and associations interested in the road problem. The whole deliberations, which have lasted three years, have been under the ægis of the Ministry of Transport. The new specifications which employ the results of their findings will ensure the general adoption of a type of asphalt road surface adapted to modern traffic conditions with the further advantage of cheapness both in first cost and in mantenance.

The specifications control not only the proportion of materials used in road making, but also their selection, so as to ensure the maximumn degree of safety under all conditions of climate. Two outstanding advantages will result from their adoption. The first is that asphalt road surfaces, which now often differ in surface as between one local area and another, will conform to one type. The second is a non-skid road surface. The specifications provide for uniform surfacing with stone chippings to be "punned" and rolled into the asphalt surface while it is soft. Further provisions in the new specifications are their admission of the use of natural asphalts in addition to those previously employed, and of finer aggregates derived from crushing processes. This latter feature is of important significance for the stone-quarrying industry of Great Britain, to which it should be of distinct assistance. The new specifications embody the experience of six years' continual progress in road construction and maintenance since the original series of specifications was issued.

Tested Analytical Reagents

Some Advantages of a New Method of Packing

MODERN analytical methods demand that only the purest and most reliable reagents shall be used. It is also of vital importance that the analyst should definitely know the maximum amounts of impurities which the reagent is liable to contain. To meet these requirements J. W. Towers and Co., Ltd., have placed on the market a range of over 200 analytical reagents of specified and guaranteed purity. To avoid all risks of contamination by dust, moisture, cork fragments, etc., each batch, after being most carefully tested, is packed into specially made amber glass bottles fitted with bakelite screw caps, which have been adopted as standard package for "Towers Tested Analytical Reagents." A rigid specification of purity is stated on the label of every bottle and every batch is carefully tested during and after manufacture. The bakelite screw caps are unaffected by all ordinary reagents and are lined with a cork wad and a waxed paper disc. As the cap fits *outside* the neck of the bottle it is entirely dustproof.

News from the Allied Industries

Mineral Oil

OIL WHICH HAD FLOWED through the pipe-line from the Kirkuk (Irak) oilfields, 600 miles away, was released into an oil tanker in the Bay of Acre on January 22, when the High Commissioner for Palestine (Sir Arthur Wauchope) opened a valve at this terminal of the pipe-line. The ceremony marked the official inauguration of the pipe-line at Haifa, which is the end of the British section.

Bleaching and Dyeing

THE ANNUAL DELEGATE MEETING of the Operative Bleachers', Dyers' and Finishers' Association (Bolton Amalgamation), held at Bolton on January 19, voted in favour of negotiations which may lead to the amalgamation of three dyers' trade unions with a total membership of 80,000 in Lancashire and Yorkshire. The other unions concerned, which have already signified their approval of the proposed negotiations, are the Amalgamated Society of Dyers, Bleachers, Finishers and Kindred Trades, and the National Union of Textile Workers.

Iron and Steel

FOLLOWING THE ANNOUNCEMENT of their demolition of blast furnaces at Blaenavon and Bennerley it is stated that Thos. W. Ward, Ltd., Sheffield, have arranged to dismantle four blast furnaces and the by-product plant belonging to the Stafford Coal and Iron Co., Ltd., Stoke-on-Trent. The work of demolition is to be started at once.

NEGOTIATIONS ARE TO BE REOPENED between the British steel industry and representatives of the International Steel Cartel to see whether an agreement cannot be reached on a basis for the entrance of the British industry to full membership of the Cartel. The first meeting was held in London early in December, without success. The Cartel demands an assured share in the British market of 900,000 tons, while Britain was unwilling to concede more than 500,000 tons. Immediately following this meeting Sir William Larke, the director of the British Iron and Steel Federation, presented Sir George May with a request from the industry that existing tariffs should be raised from 33⅓ per cent. to 50 per cent.

Continental Chemical Notes

Latvia

THE MANUFACTURE OF PHARMACEUTICAL PRODUCTS will be carried on by The Pharmasan Co. which has been registered in Riga with a capital of 100,000 lats.

Sweden

A PYRITES DEPOSIT with 2 per cent. maximum copper content located in Lapland is to be exploited by Bolidens Gruv. A.-B., who propose to erect a concentrating plant on the spot.

France

EXPERIMENTS ARE IN PROGRESS with a view to examining the possibility of incorporating dark-coloured resin with road tar or asphalt emulsions.

CALCIUM NITRATE is now reported to be in production at the new factory of the Soc. Chimique de la Grande Paroisse, at Frais Marais.

Germany

A NEW GERMAN DECREE regulating the use of ethylene oxide as a fumigant specifies a ventilating period of at least 6 hours after any enclosed spaces have been treated with the gas in place of the limit of 12 to 20 hours specified in the decree of February 26, 1932. Ethylene oxide-fumigated spaces may now be entered after analysis reveals the presence of not more than 0.5 mg. of the gas per litre.

THE GERMAN STATE ALCOHOL MONOPOLY has been granted a licence for operating the Scholler-Tornesch process for saccharification of cellulosic material by pressure percolation with dilute acids (German Pat. 577,850, 578,003 and 595,708). The State Monopoly is in turn authorised to grant sub-licences for the production of wood spirit from the sugar so obtained.

GREATER ACTIVITY IN IRON SMELTING in 1934 was reflected by increased coke production and a correspondingly greater output of by-products. Apart from pitch and naphthalene (the export of which was hindered by the foreign exchange position), a good turnover was recorded throughout the year in by-products. Over 1,500 tons of German-produced tar were used in road constructional work.

GERMAN GAS DESULPHURISING PLANTS are described in the "Chemische Industrie," January 19. With an annual capacity of over 7,000 tons the plant of the Ruhrgas A.-G., at the Nordstern Colliery, is the largest of its type for recovering sulphur from power gas. At the end of 1934 a sulphur-recovering plant was put into operation by the Mannesmann Tube Co., the capacity of which is 1,200 to 1,500 tons. The firm of Krupp recently completed a plant for isolating 1,000 tons of sulphur per annum.

Poland

THALLIUM SULPHATE AND THALLIUM CHLORIDE are now being produced by the Slaskie Kopalnie i Cynkownie at their factory in Kattowitz-Ligota.

Czecho-Slovakia

THE JULIUS RUTGERS CONCERN, of Mährisch-Ostrau, is now erecting a continuously running tar distillation plant. According to the "Chemische Industrie," this concern recently commenced the production of benzoic acid.

Switzerland

SWISS MANUFACTURERS OF SYNTHETIC RESIN PRODUCTS have formed an association with headquarters in Berne which will regulate terms of manufacture and sale and generally safeguard their common trading interests.

Austria

NEW PHARMACEUTICAL CONCERNS, registered recently in Vienna, include Eggo-Chemia Dr. Parzan and Insulin Co.

THE POSSIBILITY OF WORKING GOLD-BEARING MINES in Austria was discussed by Dr. L. Waagen, of the Federal Geological School, at a recent meeting of the Vienna Geological Society. It was stated that the installation of modern plant would enable the two gold mines at Bockstein (Salzburg) and Oberdrausburg (Carinthia) to produce 300 kg. of gold annually. An annual maximum of 3,000 kg. of gold was suggested as a possible figure for the whole country ("Chemiker-Zeitung").

Russia

CONSTRUCTION OF PLANT FOR MAGNESIUM MANUFACTURE has been commenced in the Urals, owing to the big demand for this metal.

EXTENSIVE SULPHUR DEPOSITS with a maximum sulphur content of 10 to 15 per cent. are reported to have been discovered in Russian Central Asia ("Metallbörse").

CONSIDERABLE PROGRESS HAS BEEN MADE in the cultivation of plants for essential oils in the last eleven years. Lavender, wormwood and coriander are now in regular cultivation. Two geranium-like plants, "Lasurnik" and "Gladysch," have been discovered in the wild state in the Steppes.

THE SOVIET CHEMICAL MANUFACTURING PROGRAMME for 1935 includes vulcanising accelerators (at Kineschmu), acetone and butyl alcohol (at Grosny), potassium xanthate and benzyl cellulose (at Leningrad). A factory will also be built at Moscow for producing the recently-discovered Russian quinine substitute, Otedrin.

Inventions in the Chemical Industry

Patent Specifications and Applications

THE following information is prepared from the Official Patents Journal. Printed copies of Specifications accepted may be obtained from the Patent Office, 25 Southampton Buildings, London, W.C.2, at 1s. each. The numbers given under "Applications for Patents" are for reference in all correspondence up to the acceptance of the Complete Specification.

Complete Specifications Open to Public Inspection

VALUABLE LIQUID HYDROCARBONS from hydrocarbon mixtures which contain unsaturated compounds, production.—International Hydrogenation Patents Co., Ltd. July 14, 1933. 16471/34.

PECTIN and its manufacture.—Sardik, Inc. July 11, 1933. 12005/34.

POROUS FILTER BODIES, manufacture.—I. G. Farbenindustrie. July 12, 1933. 19582/34.

PRINTING OF PADDING native or regenerated cellulose fibres or animal fibres.—Soc. of Chemical Industry in Basle. July 8, 1933. 19690/34.

MIXED CARBONYL SALICYLIC ETHER-ANHYDRIDE of salicylocarbonic acid, and homologues thereof, manufacture.—L. A. Dupont. July 11, 1933. 19783/34.

ORGANIC ESTERS, manufacture and use.—British Celanese, Ltd. July 12, 1933. 20064/34.

MEDICAMENTS, manufacture.—I. G. Farbenindustrie. July 8, 1933. 20077/34.

ETHYLENE OXIDE, manufacture.—Soc. Française de Catalyse Generalisee. July 10, 1933. 20089/34.

COMPOSITIONS OF MATTER.—I. G. Farbenindustrie. July 8, 1933. 20095/34.

ARTIFICIAL RESINS, manufacture.—Dr. H. Hönel and Beck, Koller and Co., Inc. July 14, 1933. 20148/34.

ORIGINATING-MATERIALS containing lithium phosphate, treatment. H. H. Hütte Ges. 20210/34.

CONDENSATION PRODUCTS, manufacture.—I. G. Farbenindustrie. July 12, 1933. 20241/34.

DECOLOURISING SUGAR JUICES.—Deutsche Gold-und Silber-Scheideanstalt vorm. Roessler. July 10, 1933. 20280/34.

REFINING MAGNESIUM, method.—Magnesium Products, Inc. July 11, 1933. 20342/34.

INCREASING THE FLUIDITY of coal-tar pitch.—Dr. A. Wacker Ges. für Elektro-Chemische Industrie Ges. July 13, 1933. 20466/34.

ARSENATES FROM ARSENIOUS ACID or arsenites, manufacture.—Krausz-Moskovits Vereinigte Industrie-Anlageen A.G., and Dr. M. Moskovits. July 12, 1933. 20470/34.

AZO DYES in substance or on the fibre, and of intermediates therefor, manufacture.—E. I. du Pont de Nemours and Co. July 12, 1933. 20502/34.

STABLE DIAZO-SALT PREPARATIONS, manufacture.—I. G. Farbenindustrie. July 13, 1933. 20587/34.

DESULPHURISING ARTIFICIAL FILAMENTS of viscose, method.—Dr. A. E. Stein. Jan. 12, 1933. 1243/35.

Applications for Patents

(January 10 to 16 inclusive.)

METALLIC ALUMINIUM, etc., production.—D. Baird and C. G. Miner. 912.

COLOURING COPPER, ETC.—L. C. Bannister, Imperial Chemical Industries, Ltd., and H. W. Brownsdon. 1424.

DEHYDRATION FOR PLASTIC EARTHS, process.—C. E. Blyth. 844.

AQUEOUS EMULSIONS, preparation.—H. T. Böhme A.-G. (Germany, March 16, '34.) 1272.

AMINES, preparation.—H. T. Böhme A.-G. (Germany, March 17, '34.) 1413.

ALKYLENES, preparation.—H. T. Böhme A.-G. (Germany, March 17, '34.) 1414.

CELLULOSE ESTERS, manufacture.—British Celanese, Ltd., and J. E. Jones. 1482.

SOLUTIONS OF CELLULOSE ESTERS, treatment.—British Celanese, Ltd. (Celanese Corporation of America). 858.

COPPER IN MANUFACTURE OF CUPRAMMONIUM ARTIFICIAL SILK, recovery.—A. Carpmael (Duisburger Kupferhütte and I. G. Farbenindustrie.) 1403.

9.10-BENZO-β-HYDROXY-PHENANTHRENE-*o*-CARBOXYLIC ACID, manufacture.—A. Carpmael (I. G. Farbenindustrie). 938.

ARTIFICIAL FIBRES, ETC., treatment.—A. Carpmael. 1039.

CONDENSATION PRODUCTS, manufacture.—A. Carpmael. 1404.

ESTERS, manufacture.—Celluloid Corporation. (United States, Jan. 12, '34.) 1191.

LIQUEFIED GASES, ETC., handling.—N. D. Chopra. 946.

AMINOPHENOLS, manufacture.—R. G. Clarkson, R. F. Deese, F. B. Downing, and E. I. du Pont de Nemours and Co. 1034.

ORGANIC CONDENSATION PRODUCTS, manufacture.—Deutsche Hydrierwerke A.-G. (Germany, Jan. 16, '34.) 1521.

ORGANIC CONDENSATION PRODUCTS, manufacture.—Deutsche Hydrierwerke A.-G. (Germany, Jan. 21, '34.) 1522.

AZO DYESTUFFS, manufacture.—E. I. du Pont de Nemours and Co., E. F. Hitch, M. E. P. Friedrich, and M. A. Rahlen. 1033.

WATER-SOLUBLE AMINO ACIDS and ammonium sulphate, separation of mixtures comprising.—Ges. für Kohlentechnik. (Germany, May 18, '34.) 931. (Germany, Oct. 10, '34.) 932.

AZO DYESTUFFS, manufacture.—E. I. du Pont de Nemours and Co., and M. A. Rahlen. 1423.

CARBON BLACK, production.—J. Dusék and F. Zwilgmeyer. (Czecho-Slovakia, July 18, '34.) 1305.

NICKEL, ETC., producing.—Falconbridge Nikkelverk Aktieselskap. (Norway, Jan. 15, '34.) 1271.

CHROMIFEROUS DYESTUFFS, manufacture.—W. W. Groves. 890.

ALKALI CELLULOSE, manufacture.—W. W. Groves. 1214.

THE HORMONE OF SUPRARENAL CORTEX, manufacture.—W. W. Groves. 1374.

ALGINOUS MATERIAL from seaweed, recovery.—J. R. Herter. (France, Jan. 11, '34.) 1027.

2-KETO-LAEVO-GULONIC ACID, manufacture.—F. Hoffmann-La Roche and Co. A.-G. (Switzerland, March 15, '34.) 866.

ACRIDINIUM COMPOUNDS, manufacture.—I. G. Farbenindustrie. (Germany, Jan. 13, '34.) 1040.

ORGANIC MERCURY-SILICON COMPOUNDS, manufacture.—I. G. Farbenindustrie. (Germany, Jan. 20, '34.) 1129. (Germany, June 13, '34.) 1130.

FREE ω-METHANE-SULPHONIC ACIDS of pyrazolone-amines, manufacture.—I. G. Farbenindustrie. (Germany, Jan. 13, '34.) 1215.

4 : 4^1-DIMETHOXYDIPHENYLAMINE, manufacture.—Imperial Chemical Industries, Ltd., W. Baird, C. R. Mavin and A. G. Murray. 1036.

AMINO-AZO-PHENANTHRENES, manufacture.—J. Y. Johnson (I. G. Farbenindustrie). 869.

METALLIC MAGNESIUM, electrolytic manufacture.—Y. Kato. (Japan, March 30, '34.) 1077.

DRY GLUES from dextrin, production.—Jagenberg-Werke A.-G. (Germany, Jan. 11, '34.) 1026.

ORGANIC COMPOUNDS containing diplogen, manufacture.—J. Kenner and P. Szego. 840.

ALKALI NITRATES, production.—P. Kubelka. (Germany, Jan. 15, '34.) 1399.

BITUMEN SHEETING.—Ruberoid Co., Ltd. 1524.

HORMONES, production.—Schering-Kahlbaum A.-G. (Germany, Jan. 16, '34.) 1540, 1541. (Germany, Sept. 15, '34.) 1542.

CEMENT, manufacture.—Soc. Anon. des Ciments de Thieu. (Belgium, Jan. 13, '34.) 1067. (Belgium, March 23, '34.) 1068.

CONVERSION PRODUCTS of N-nitramines of primary aromatic amines nitrated in the nucleus, manufacture.—Soc. of Chemical Industry in Basle. (Switzerland, Jan. 27, '34.) 1220. (Switzerland, Dec. 14, '34.) 1221.

AZO DYESTUFFS, manufacture.—Soc. of Chemical Industry in Basle. (Switzerland, Jan. 23, '34.) 1373.

DESULPHURISING ARTIFICIAL FILAMENTS of viscose.—A. E. Stein. (Jan. 12, '34.) (Germany, Jan. 12, '33.) 1243.

Specifications Accepted with Dates of Application

STRIPPING DYED TEXTILES.—Imperial Chemical Industries, Ltd., J. G. Evans and L. G. Lawrie. April 7, 1933. 422,466.

CHLORINATED RUBBER PRODUCTS and apparatus therefor, production.—W. D. Spencer and Imperial Chemical Industries, Ltd. June 8, 1933. 422,192.

WATER-SOLUBLE DIAZOIMINO COMPOUNDS and their application.—E. I. du Pont de Nemours and Co. July 27, 1932. 422,195.

HIGH-QUALITY LUBRICATING OILS, manufacture and production.—J. Y. Johnson (I. G. Farbenindustrie). July 6, 1933. 422,471.

DYESTUFF INTERMEDIATE, manufacture.—Imperial Chemical Industries, Ltd., A. H. Knight, and W. A. Sexton. July 6, 1933. 422,417.

THERMAL TREATMENT of carbonaceous materials, lining apparatus for.—J. Y. Johnson (I. G. Farbenindustrie). July 7, 1933. 422,273.

METALLIC MATERIAL, method of manufacture.—O. M. Otte. July 13, 1932. 422,347.

GREEN FODDER, preservation.—W. W. Groves (I. G. Farbenindustrie). July 10, 1933. 422,350.

METALLIC CATALYSTS by electrolytic methods, production.—Technical Research Works, Ltd., E. R. Bolton, K. A. Williams, and H. R. Mitchell. July 10, 1933. 422,353.

VULCANISATION ACCELERATORS, production and use of compounds suitable for use.—W. J. Tennant (Rubber Service Laboratories Co.). July 10, 1933. 422,354.

SECONDARY DISAZO DYES, manufacture and application.—Imperial Chemical Industries, Ltd., and A. H. Knight. July 18, 1933. 422,422.

MORDANT DYESTUFFS, manufacture.—Durand and Huguenin A.-G. Aug. 24, 1932. 422,287.

POLYMERIC CARBOXYLIC ACIDS, manufacture of products from.—I. G. Farbenindustrie. Nov. 5, 1932. 422,360.

Weekly Prices of British Chemical Products

Review of Current Market Conditions

CONDITIONS have remained steady in the general heavy chemical market and there have been no changes in the prices of rubber chemicals, wood distillation products, perfumery chemicals, intermediates and dyes. Salt cake (unground) and soda ash both show a reduction of 2s. 6d. per ton, and commercial sodium sulphite, which has been quoted at £9 10s. per ton since October, 1934, has been reduced by 15s. per ton. Slight reductions are also reported in one or two pharmaceutical and photographic chemicals, while in the essential oils section the price of lemongrass has been advanced by 5d. per lb. Unless otherwise stated the prices quoted below cover fair quantities net and naked at sellers' works.

Price Changes

General Chemicals.—SALT CAKE, unground, £3 12s. 6d. per ton; SODA ASH, 58%, spot, £5 12s. 6d.; SODIUM SULPHITE, commercial, £8 15s.

Pharmaceutical Chemicals.—CHLOROFORM, 2s. 2¼d. to 2s. 8d. per lb.; SODIUM HYPOSULPHITE, £14 15s. per ton.

Essential Oils.—LEMONGRASS, 4s. 3d. per lb.

Coal Tar Products.—MOTOR BENZOL (London), 1s. 5½d. per gal.; CREOSOTE, 4½d. to 5d., Manchester, 4½d. to 5¼d.; SOLVENT NAPHTHA (London), 1s. 2½d. to 1s. 3½d.; PITCH (London), 45s. per ton.

All other prices remain unchanged.

LONDON.—The London chemical market for practically all products continues firm with quite a satisfactory volume of inquiry. Prices continue remarkably steady and there are no changes to report. There is a fair demand for coal tar products. Some of them have stiffened considerably in price, and there is an increasing demand for creosote oil, which is very scarce.

MANCHESTER.—Steady price conditions continue to be reported in virtually all sections of the Manchester chemical market. In one or two of the potash materials a slightly easier tendency is in evidence here and there, but as regards the general run of the potash compounds values are well maintained, and this is also the case with the soda and ammonia and most other classes of products. Forward buying during the past week has not been of very great consequence, but existing contracts are being steadily drawn against and whilst additional improvement in conditions at the consuming end is not much in evidence most traders agree that from the point of view of deliveries the year has opened out fairly satisfactorily. Little further weakness has developed in the by-products, but, for the most part, business continues on a restricted scale, with creosote oil about the most attractive section.

SCOTLAND.—Business in the Scottish heavy chemical market is improving slightly and there are no changes in prices.

General Chemicals

ACETONE.—LONDON: £65 to £68 per ton; SCOTLAND: £66 to £68 ex wharf, according to quantity.

ACID, ACETIC.—Tech. 80%, £38 5s. to £40 5s.; pure 80%, £39 5s.; tech., 40%, £20 5s. to £21 15s.; tech., 60%, £28 10s. to £30 10s. LONDON: Tech., 80%, £38 5s. to £40 5s.; pure 80%, £39 5s. to £41 5s.; tech., 40%, £20 5s. to £22 5s.; tech., 60%, £29 5s. to £31 5s. SCOTLAND: Glacial 98/100%, £48 to £52; pure 80%, £39 5s.; tech. 80%, £38 5s. d/d buyers' premises Great Britain. MANCHESTER: 80%, commercial, £39; tech. glacial, £52.

ACID, BORIC.—Commercial granulated, £25 10s. per ton; crystal, £26 10s.; powdered, £27 10s.; extra finely powdered, £29 10s. packed in 1-cwt. bags, carriage paid home to buyers' premises within the United Kingdom in 1-ton lots.

ACID, CHROMIC.—10½d. per lb., less 2½%, d/d U.K.

ACID, CITRIC.—11¾d. per lb. less 5%. MANCHESTER: 11¾d.

ACID, CRESYLIC.—97/99%, 1s. 8d. to 1s. 9d. per gal.; 98/100%, 2s. to 2s. 2d.

ACID, FORMIC.—LONDON: £40 to £45 per ton.

ACID, HYDROCHLORIC.—Spot, 4s. to 6s. carboy d/d according to purity, strength and locality. SCOTLAND: Arsenical quality, 4s.; dearsenicated, 5s. ex works. full wagon loads.

ACID, LACTIC.—LANCASHIRE: Dark tech., 50% by vol., £24 10s. per ton; 50% by weight, £28 10s.; 80% by weight, £48; pale tech., 50% by vol., £28; 50% by weight, £33; 80% by weight, £53; edible, 50% by vol., £41. One-ton lots ex works, barrels free.

ACID, NITRIC.—80° Tw. spot, £18 to £25 per ton makers' works, SCOTLAND: 80°, £23 ex station full truck loads.

ACID, OXALIC.—LONDON: £47 17s. 6d. to £57 10s. per ton, according to packages and position. SCOTLAND: 98/100%, £48 to £50 ex storee. MANCHESTER: £48 10s. to £55 ex store.

ACID, SULPHURIC.—SCOTLAND: 144° quality, £3 12s. 6d.; 168°, £7; dearsenicated, 20s. per ton extra.

ACID, TARTARIC.—1s. per lb. less 5%, carriage paid for lots of 5 cwt. and upwards. MANCHESTER: 1s. 0¾d. per lb.

ALUM.—SCOTLAND: Lump potash, £8 10s. per ton ex store.

ALUMINA SULPHATE.—LONDON: £7 10s. to £8 per ton. SCOTLAND: £7 to £8 ex store.

AMMONIA, ANHYDROUS.—Spot, 10d. per lb. d/d in cylinders. SCOTLAND: 10d. to 1s. containers extra and returnable.

AMMONIA, LIQUID.—SCOTLAND: 80°, 2½d. to 3d. per lb., d/d.

AMMONIUM BICHROMATE.—8d. per lb. d/d U.K.

AMMONIUM CARBONATE, SCOTLAND: Lump, £30 per ton; powdered, £33, in 5-cwt. casks d/d buyers' premises U.K.

AMMONIUM CHLORIDE.—£37 to £45 per ton, carriage paid. LONDON: Fine white crystals, £18 to £19. (See also Salammoniac.)

AMMONIUM CHLORIDE (MURIATE).—SCOTLAND: British dog tooth crystals, £32 to £35 per ton carriage paid according to quantity. (See also Salammoniac.)

ANTIMONY OXIDE.—SCOTLAND: Spot, £34 per ton, c.i.f. U.K. ports.

ANTIMONY SULPHIDE.—Golden, 6¾d. to 1s. 2d. per lb.; crimson, 1s. 5d. to 1s. 7d. per lb., according to quality.

ARSENIC.—LONDON: £16 10s. per ton c.i.f. main U.K. ports for imported material; Cornish nominal, £22 10s. f.o.r mines. SCOTLAND: White powdered, £23 ex wharf. MANCHESTER: White powdered Cornish, £21 ex store.

ARSENIC SULPHIDE.—Yellow, 1s. 5d. to 1s. 7d. per lb.

BARIUM CHLORIDE.—£11 per ton. SCOTLAND: £10 10s.

BARYTES.—£6 10s. to £8 per ton.

BISULPHITE OF LIME.—£6 10s. per ton f.o.r. London.

BLEACHING POWDER.—Spot, 35/37%, £7 19s. per ton d/d station in casks, special terms for contract. SCOTLAND: £8 in 5/6 cwt. casks for contracts over 1934/1935.

BORAX, COMMERCIAL.—Granulated, £14 10s. per ton; crystal, £15 10s.; powdered, £16; finely powdered, £17; packed in 1-cwt. bags, carriage paid home to buyer's premises within the United Kingdom in 1-ton lots.

CADMIUM SULPHIDE.—2s. 5d. to 2s. 9d.

CALCIUM CHLORIDE.—Solid 70/75% spot, £5 5s. per ton d/d station in drums.

CARBON BISULPHIDE.—£30 to £32 per ton, drums extra.

CARBON BLACK.—3¾d. to 4¾d. per lb. LONDON: 4½d. to 5d.

CARBON TETRACHLORIDE.—SCOTLAND: £41 to £43 per ton, drums extra.

CHROMIUM OXIDE.—10¾d. per lb., according to quantity d/d U.K.; green, 1s. 2d. per lb.

CHROMETAN.—Crystals, 3¼d. per lb.; liquor, £19 10s. per ton d/d.

COPPERAS (GREEN).—SCOTLAND: £3 15s. per ton, f.o.r. or ex works.

CREAM OF TARTAR.—LONDON: £4 2s. 6d. per cwt. SCOTLAND: £4 2s. less 2½ per cent.

DINITROTOLUENE.—66/68° C., 9d. per lb.

DIPHENYLGUANIDINE.—2s. 2d. per lb.

FORMALDEHYDE.—LONDON: £25 10s. per ton. SCOTLAND: 40%, £25 to £28 ex store.

IODINE.—Resublimed B.P., 6s. 3d. to 8s. 4d. per lb.

LAMPBLACK.—£45 to £48 per ton.

LEAD ACETATE.—LONDON: White, £34 10s. per ton; brown, £1 per ton less. SCOTLAND: White crystals, £33 to £35; brown, £1 per ton less. MANCHESTER: White, £34; brown, £32.

LEAD NITRATE.—£27 10s. per ton.

LEAD, RED.—SCOTLAND: £24 to £26 per ton less 2½%; d/d buyer's works.

LEAD, WHITE.—SCOTLAND: £39 per ton, carriage paid. LONDON: £36 10s.

LITHOPONE.—30%, £17 to £17 10s. per ton.

MAGNESITE.—SCOTLAND: Ground calcined, £9 per ton, ex store.

METHYLATED SPIRIT.—61 O.P. industrial, 1s. 5d. to 2s. per gal.; pyridinised industrial, 1s. 7d. to 2s. 2d.; mineralised, 2s. 6d. to 3s. Spirit 64 O.P. is 1d. more in all cases and the range of prices is according to quantities. SCOTLAND: Industrial 64 O.P., 1s. 9d. to 2s. 4d.

NICKEL AMMONIUM SULPHATE.—£49 per ton d/d.

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PHENOL.—7¾d. to 8¼d. per lb. for delivery up to June 30.

POTASH, CAUSTIC.—LONDON: £42 per ton. MANCHESTER: £38 10s.

POTASSIUM BICHROMATE.—Crystals and Granular, 5d. per lb. less 5% d/d U.K. Discount according to quantity. Ground, 5¼d. LONDON: 5d. per lb. less 5%, with discounts for contracts. SCOTLAND: 5d. d/d U.K. or c.i.f. Irish Ports. MANCHESTER: 5d.

POTASSIUM CHLORATE.—LONDON: £37 to £40 per ton. SCOTLAND: 99¾/100%, powder, £37. MANCHESTER: £37 10s.

POTASSIUM CHROMATE.—6½d. per lb. d/d U.K.

POTASSIUM IODIDE.—B.P., 5s. 2d. per lb.

POTASSIUM NIRATE.—SCOTLAND : Refined granulated, £29 per ton c.i.f. U.K. ports. Spot, £30 per ton ex store.
POTASSIUM PERMANGANATE.—LONDON : 9¾d. per lb. SCOTLAND : B.P. crystals, 9d. MANCHESTER : B.P., 10¼d.
POTASSIUM PRUSSIATE.—LONDON : Yellow, 8¼d. to 8¾d. per lb. SCOTLAND : Yellow spot, 8½d. ex store. MANCHESTER : Yellow, 8¼d.
SALAMMONIAC.—First lump spot, £41 17s. 6d. per ton d/d in barrels.
SODA ASH.—58% spot, £5 12s. 6d. per ton f.o.r in bags.
SODA, CAUSTIC.—Solid 76/77° spot, £13 17s. 6d. per ton d/d station. SCOTLAND : Powdered 98/99%, £17 10s. in drums, £18 5s. in casks, Solid 76/77°, £14 10s. in drums; 70/73%, £14 12s. 6d., carriage paid buyer's station, minimum 4-ton lots; contracts 10s. per ton less. MANCHESTER : £13 5s. to £14 contracts.
SODA CRYSTALS.—Spot, £5 to £5 5s. per ton d/d station or ex depot in 2-cwt. bags.
SODIUM ACETATE.—£22 per ton. LONDON : £23.
SODIUM BICARBONATE.—Refined spot, £10 10s. per ton d/d station in bags. SCOTLAND . Refined recrystallised £10 15s. ex quay or station. MANCHESTER : £10 10s.
SODIUM BICHROMATE.—Crystals cake and powder 4d. per lb. net d/d U.K. discount according to quantity. Anhydrous, 5d. per lb. LONDON : 4d. per lb. less 5% for spot lots and 4d. per lb. with discounts for contract quantities. MANCHESTER : 4d. per lb. basis. SCOTLAND : 4d. delivered buyer's premises with concession for contracts.
SODIUM BISULPHITE POWDER.—60/62%, £18 10s. per ton d/d 1-cwt. iron drums for home trade.
SODIUM CARBONATE (SODA CRYSTALS).—SCOTLAND : £5 to £5 5s. per ton ex quay or station. Powdered or pea quality 7s. 6d. per ton extra. Light Soda Ash £7 ex quay, min. 4-ton lots with reductions for contracts.
SODIUM CHLORATE.—£32 10s. per ton.
SODIUM CHROMATE.—4d. per lb. d/d U.K.
SODIUM HYPOSULPHITE.—SCOTLAND : Large crystals English manufacture, £9 5s. per ton ex stations, min. 4-ton lots. Pea crystals, £14 10s. ex station, 4-ton lots. MANCHESTER : Commercial, £10 5s.; photographic, £15.
SODIUM META SILICATE.—£16 per ton, d/d U.K. in cwt. bags.
SODIUM IODIDE.—B.P., 6s. per lb.
SODIUM NITRITE.—LONDON . Spot, £18 to £20 per ton d/d station in drums.
SODIUM PERBORATE.—LONDON : 10d. per lb. ·
SODIUM PHOSPHATE.—£13 per ton.
SODIUM PRUSSIATE.—LONDON : 5d. to 5½d. per lb. SCOTLAND : 5d. to 5¾d. ex store. MANCHESTER : 5d. to 5½d.
SULPHUR.—£9 15s. to £10 per ton. SCOTLAND : £8 to £9.
SODIUM SILICATE.—140° Tw. Spot £8 per ton. SCOTLAND : £8 10s.
SODIUM SULPHATE (GLAUBER SALTS).—£4 2s. 6d. per ton d/d SCOTLAND : English material £3 15s.
SODIUM SULPHATE (SALT CAKE).—Unground spot, £3 12s. 6d. per ton d/d station in bulk. SCOTLAND : Ground quality, £3 5s. per ton d/d. MANCHESTER : £3 5s.
SODIUM SULPHIDE —Solid 60/62% Spot, £10 15s. per ton d/d in drums; crystals 30/32%, £8 per ton d/d in casks. SCOTLAND : For home consumption, Solid 60/62%, £10 5s.; broken 60/62%, £11 5s.; crystals, 30/32%, £8 2s. 6d., d/d buyer's works on contract, min. 4-ton lots. Spot solid 5s. per ton extra. Crystals, 2s. 6d. per ton extra. MANCHESTER : Concentrated solid, 60/62%, £11; commercial, £8 2s. 6d.
SODIUM SULPHITE.—Pea crystals spot, £13 10s. per ton d/d station in kegs. Commercial spot, £8 15s. d/d station in bags.
SULPHATE OF COPPER.—MANCHESTER : £14 to £14 5s. per ton f.o.b.
SULPHUR CHLORIDE.—5d. to 7d. per lb., according to quality.
SULPHUR PRECIP.—B.P. £55 to £60 per ton according to quantity. Commercial, £50 to £55.
VERMILION.—Pale or deep, 3s. 11d. to 4s. 1d. per lb.
ZINC CHLORIDE.—SCOTLAND · British material, 98%, £18 10s. per ton f.o.b. U.K. ports.
ZINC SULFHATE.—LONDON : £12 per ton. SCOTLAND : £10 10s.
ZINC SULPHIDE.—11d. to 1s. per lb.

Coal Tar Products

ACID, CARBOLIC.—Crystals, 7¾d. to 8¼d. per lb.; crude, 60's, 1s. 1½d. to 2s. 2½d. per gal. MANCHESTER : Crystals, 7¾d. per lb.; crude, 1s. 11d. per gal. SCOTLAND : 60's, 2s. 6d. to 2s. 7d.
ACID, CRESYLIC.—90/100%, 1s. 8d. to 2s. 3d. per gal.; pale 98%, 1s. 6d. to 1s. 7d.; according to specification. LONDON : 98/100%, 1s. 4d.; dark, 95/97%, 1s. SCOTLAND : Pale, 99/100%, 1s. 3d. to 1s. 4d.; dark, 97/99%, 1s. to 1s. 1d.; high boiling acid, 2s. 6d. to 3s.
BENZOL.—At works, crude, 9d. to 9½d. per gal.; standard motor, 1s. 3½d. to 1s. 4d.; 90%, 1s. 4d. to 1s. 4½d.; pure, 1s. 7½d. to 1s. 8d. LONDON : Motor, 1s. 5½d. SCOTLAND : Motor, 1s. 6½d.
CREOSOTE.—B.S.I. Specification standard, 5d. per gal. f.o.r. Home, 3¾d. d/d. LONDON : 4½d. f.o.r. North; 5d. London. MANCHESTER : 4½d. to 5¼d. SCOTLAND : Specification oils, 4d.; washed oil, 4¼d. to 4¾d.; light, 4½d.; heavy, 4¼d. to 4½d.
NAPHTHA.—Solvent, 90/160%, 1s. 6d. to 1s. 7d. per gal.; 95/160%, 1s. 7d.; 99%, 11d. to 1s. 1d. LONDON : Solvent, 1s. 2½d. to 1s. 3½d.; heavy, 11d. to 1s. 0½d. f.o.r. SCOTLAND : 90/160%, 1s. 3d. to 1s. 3½d.; 90/190%, 11d. to 1s. 2d.
NAPHTHALENE.—Purified crystals, £10 per ton in bags. LONDON : Fire lighter quality, £3 to £3 10s.; 74/76 quality, £4 to £4 10s.; 76/78 quality, £5 10s. to £6. SCOTLAND : 40s. to 50s.; whizzed, 70s. to 75s.
PITCH.—Medium soft, 48s. per ton. LONDON : 45s. per ton, f.o.b. East Coast port.
PYRIDINE.—90/140, 6s. 9d. to 2s. 6d. per gal.; 90/180, 2s. 3d.
TOLUOL.—90%, 1s. 10d. to 1s. 11d. per gal.; pure, 2s. 2d. to 2s. 3d.
XYLOL.—Commercial, 1s. 11d. to 2s. per gal.; pure, 2s. 1d. to 2s. 2d.

Intermediates and Dyes

ACID, BENZOIC, 1914 B.P. (ex Toluol).—1s. 9½d. per lb.
ACID, GAMMA.—Spot, 4s. per lb. 100% d/d buyer's works.
ACID, H.—Spot, 2s. 4½d. per lb. 100% d/d buyer's works.
ACID NAPHTHIONIC.—1s. 8d. per lb.
ACID, NEVILLE AND WINTHER.—Spot, 3s. per lb. 100%.
ACID, SULPHANILIC.—Spot, 8d. per lb. 100% d/d buyer's works.
ANILINE OIL.—Spot, 8d. per lb., drums extra, d/d buyer's works.
ANILINE SALTS.—Spot, 8d. per lb. d/d buyer's works, casks free.
BENZALDEHYDE.—Spot, 1s. 8d. per lb., packages extra.
BENZIDINE BASE.—Spot, 2s. 5d. per lb., 100% d/d buyer's works.
BENZIDINE HCL.—2s. 5d. per lb.
p CRESOL 34-5° C.—2s. per lb. in ton lots.
m-CRESOL 98/100%.—2s. 3d. per lb. in ton lots.
DICHLORANILINE.—1s. 11½d. to 2s. 3d. per lb.
DIMETHYLANILINE.—Spot, 1s. 6d. per lb., package extra.
DINITROBENZENE.—8d. per lb.
DINITROTOLUENE.—48/50° C., 9d. per lb.; 66/68° C., 01½d.
DINITROCHLORBENZENE, SOLID.—£72 per ton.
DIPHENYLAMINE.—Spot, 2s. per lb., d/d buyer's works.
α-NAPHTHOL.—Spot, 2s. 4d. per lb., d/d buyer's works.
β-NAPHTHOL.—Spot, £78 15s. per ton in paper bags.
α-NAPHTHYLAMINE.—Spot, 11½d. per lb., d/d buyer's works.
β-NAPHTHYLAMINE.—Spot, 2s. 9d. per lb., d/d buyer's works.
o-NITRANILINE.—3ss. 11d. per lb.
m-NITRANILINE.—Spot, 2s. 7d. per lb., d/d buyer's works.
p-NITRANILINE.—Spot, 1s. 8d. per lb., d/d buyer's works.
NITROBENZENE.—Spot, 4½d. to 5d. per lb.; 5-cwt. lots, drums extra.
NITRONAPHTHALENE.—9d. per lb.; P.G., 1s. 0½d. per lb.
SODIUM NAPHTHIONATE.—Spot, 1s. 9d. per lb.
o-TOLUIDINE.—9½d. to 11d. per lb.
p-TOLUIDINE.—1s. 11d. per lb.

Wood Distillation Products

ACETATE OF LIME.—Brown, £9 to £10. Grey, £12 to £14. Liquor, brown, 30° Tw., 8d. per gal. MANCHESTER : Brown, £11; grey, £13 10s.
ACETIC ACID, TECHNICAL, 40%.—£17 to £18 per ton.
AMYL ACETATE, TECHNICAL.—95s. to 110s. per cwt.
CHARCOAL.—£5 15s. to £10 per ton.
WOOD CREOSOTE.—Unrefined, 3d. to 1s. 6d. per gal.
WOOD NAPHTHA, MISCIBLE.—2s. 6d. to 3s. 6d. per gal.; solvent, 3s. 6d. to 4s. per gal.
WOOD TAR.—£2 to £4 per ton.

Nitrogen Fertilisers

SULPHATE OF AMMONIA.—Jan., £7 2s.; Feb., £7 3s. 6d.; Mar./June, £7 5s.; for neutral quality basis 20.6% nitrogen delivered in 6-ton lots to farmer's nearest station.
CYANAMIDE.—Jan., £7 1s. 3d.; Feb., £7 2s. 6d.; Mar., £7 3s. 9d.; Apr./June, £7 5s.; delivered in 4-ton lots to farmer's nearest station.
NITRATE OF SODA.—£7 12s. 6d. per ton for delivery to June, 1935, in 6-ton lots, carriage paid to farmer's nearest station for material basis 15.5% or 16% nitrogen.
NITRO-CHALK.—£7 5s. per ton to June, 1935, in 6-ton lots carriage paid for material basis 15.5% nitrogen.
CONCENTRATED COMPLETE FERTILISERS.—£10 5s. to £10 17s. 6d. per ton according to percentage of constituents, for delivery up to June, 1935, in 6-ton lots carriage paid.
NITROGEN PHOSPHATE FERTILISERS.—£10 5s. to £13 15s. per ton, for delivery up to June, 1935, in 6-ton lots carriage paid.

Latest Oil Prices

LONDON, Jan. 23.—LINSEED OIL was firm. Spot, £22 15s. (small quantities 30s. extra); Feb., £2el 7s. 6d.; Feb.-April, £21 12s. 6d.; May-Aug., £22 2s. 6d.; Sept.-Dec., £22 10s., naked. SOYA BEAN OIL was firm. Oriental (bulk), Jan.-Feb. shipment, £23 10s. per ton. RAPE OIL was firm. Crude extracted, £31 10s.; technical refined, £33, naked, ex wharf. COTTON OIL was firm. Egyptian crude, £26 10s.; refined common edible, £31; deodorised, £32 10s., naked, ex mill (small lots 30s. extra). TURPENTINE was steady. American, spot, 48s. 3d. per cwt.

HULL.—LINSEED OIL.—Spot, quoted £21 17s. 6d. per ton; Jan., £21 10s.; Feb.-April, £21 15s.; May-Aug., £22 5s.; Sept.-Dec., £23. COTTON OIL.—Egyptian, crude, spot, £27; edible, refined spot, £29 10s.; technical, spot, £29 10s.; deodorised, £31 10s., naked. PALM KERNEL OIL.—Crude, f.m.q., spot, £20 10s. naked. GROUNDNUT OIL.—Extracted, spot, £33 10s; deodorised, £36 10s. RAPE OIL.—Extracted, spot, £30; refined, £31 10s. SOYA OIL.—Extracted, spot, £25; deodorised £28 per ton. CASTOR OIL.—Pharmaceutical, 40s. 6d.; first, 35s. 6d.; second, 32s. 6d. per cwt. TURPENTINE, American, spot, 50s. 3d. per cwt.

From Week to Week

THE WORKS OF THE LANCASHIRE STEEL CORPORATION was visited on January 18, by Mr. Oliver Stanley, Minister of Labour.

THE INDIA TYRE AND RUBBER CO. has made a distribution of £413 to Glasgow, Paisley, and Renfrew infirmaries and nursing associations.

THE POTASH SYNDICATE had sales during 1934 amounting to 1,220,000 metric tons, compared with 937,000 metric tons in 1933 and only 837,000 metric tons in 1932.

THE SOUTH WALES SECTION of the Society of Chemical Industry has arranged a visit to the dry coal cleaning plant of Insole's, Porth, on January 31.

GAS FUEL for motor vehicles has recently been experimented with in Germany and the German police authorities have given permission to two manufacturing firms to produce gas containers with a capacity of 10 gallons and weight of 110 lb.

THE GOVAN IRONWORKS, GLASGOW, of Wm. Dixon, Ltd., is to install a new battery of coke ovens. The equipment, which is being supplied by Simon Carves, Ltd., Manchester, will comprise ovens of the under-jet compound type, the design permitting of firing by oven gas and blast furnace gas as well as by coke.

THE ARDEER CHEMICAL CLUB held its annual smoking concert last week in the Eglinton Hotel, Ardrossan. About 60 were present, including Captain Riecht, of the Belgian Government, and a number of members from the associated chemical societies in Glasgow and the West of Scotland.

TENDERS for the supply of refined tar and compounds for the year ending March 31, 1936, are invited by the St. Germans Rural District Council, to reach the Clerk to the Council, Mr. J. Percival Heath, at 53 Fore Street, Saltash, not later than February 5. Details are available from the surveyor, Mr. R. L. Bailey, St. Stephen's Mount, Saltash, Cornwall.

THE DIRECTORS OF BENN BROTHERS, LTD., publishers of THE CHEMICAL AGE, have declared the usual dividends, less tax, payable on February 15, viz.: 3 per cent. on the preference shares for the half year ended December 31, 1934, and interim dividends of 5 per cent. on the ordinary shares, and 1s. per share on the deferred shares.

TENDERS for the supply of road dressings, cement, disinfectants, engine and lubricating oils, paints, oils, etc., during the twelve months ending March 31, 1936, are invited by the Exmouth Urban District Council, to be delivered to the clerk to the Council, Council Offices, Exmouth, not later than noon on January 28. Details are available from the engineer and surveyor, Mr. Samuel Hutton.

THE INSTITUTE OF PHYSICS has selected Manchester as the meeting-place for a conference to be held from March 28 to March 30, at which Professor W. L. Bragg, who occupies the chair of physics at the University of Manchester, will preside. The conference is one of a series that has been planned to promote the application of physics to industry and to assist those engaged in industrial research.

A CONFERENCE of employers' and workmen's representatives in the coke and by-product industries at Cardiff last week failed to agree on wages' discussions. The men's representatives applied for the restoration of the 6½ per cent. reduction made in the award made in 1931, while the employers' representatives asked for a reduction of 10 per cent. It was eventually agreed that the Ministry of Labour be asked to appoint an arbitrator under the terms of the Industrial Court to deal with the matter.

IN THE KING'S BENCH DIVISION on Monday, Mr. Justice Singleton had before him an action by Mr. Charles Elmche Henry, a traveller of Woodlands Gardens, Isleworth, against Alcock (Peroxide), Ltd., of Luton, to recover £391 odd, commission due under an agreement of February, 1932. Plaintiff's case was that he had obtained orders for goods between February, 1933, and September, 1934, to the amount of £1,598, in excess of the orders he had to obtain in consideration of his salary of £400 a year. During the progress of the case a settlement was arrived at, and by consent, judgment was entered for plaintiff for £371 with costs, it being stated that defendants had already paid plaintiff a cheque for £20 odd.

DR. C. H. DESCH, superintendent of the metallurgy department at the National Physical Laboratory, Teddington, delivered the James Watt anniversary lecture at Greenock, on January 18, taking as his subject "Metallurgical Research and Engineering." The lecture is given under the auspices of the Greenock Philosophical Society, and Mr. R. F. Lyle, the president, presided over a large attendance, which included many members of the staffs of the shipyards and engineering establishments in the district. Dr. Desch said that the modern physical theories of the constitution of solids had shed much light on the behaviour of metals and alloys when subjected to changes of temperature or of stress, and to the age-old empirical knowledge of metals was being added a scientific knowledge which was bound to have a determining influence on the engineering practice of the future.

A MAN WAS KILLED in an explosion at the works of Fumigating Services, Ltd., Barking, on the night of January 23.

THE MEXICAN GOVERNMENT has issued a decree exempting petrol and other petroleum products from import duties.

AN APPEAL is pending against the judgment of Mr. Justice Eve in the Chancery Division approving a scheme for the capital reorganisation of Dorman, Long and Co.

THE EMPLOYEES of the Alexandria Works, Alexandria (of the United Turkey Red Co., Ltd.), have subscribed £107 to infirmaries and charitable institutions during the past year.

THE IRISH FREE STATE during November imported chemicals, drugs and similar goods (including chemical fertilisers) to the value of £104,727, as compared with £130,163 in the corresponding period of 1933.

THE IMPORT DUTIES ADVISORY COMMITTEE announces that it is now prepared to receive evidence, forwarded in writing, not later than February 6, on supplies and prices of lead and zinc, and the provisions of the Ottawa Agreements in regard thereto.

SCOTTISH OILS, LTD., are considering re-opening Viewfield Shale pit near Tarbrax, Lanarkshire. Until 1927, Tarbrax supported a population of 2,150, and it is claimed that unemployment would be greatly reduced if the Scottish shale oil industry was placed back on the 1926 basis, when 12,500 men were employed.

ARRANGEMENTS AND OBJECTS of the sixth International Congress for Scientific Management are to be discussed at a meeting at the offices of the Federation of British Industries in London, on February 1, to be presided over by Sir George Beharrell, chairman of the Congress.

THE INSTITUTE OF PHYSICS on January 15 elected the following to membership: Fellows: J. W. Buckley, Dr. J. N. Carruthers, E. G. Cox, F. H. Gage, D. T. Jones, Dr. C. Sykes, and Dr. H. C. Webster. Associates: H. G. Jones, S. J. Metzler, M. P. Quinlivan, G. D. Rochester, Dr. R. Roscoe, and W. H. Willott.

FUMIGATION of dried fruits with hydrocyanic acid gas may be dangerous to the public, according to the Hull city analyst (Mr. Arnold R. Tankard), who commented on the "modern trend in food sophistication" in a report to Hull Cleansing and Sanitary Committee on January 23.

THE MIDLAND CHEMISTS' COMMITTEE will hold its annual dinner-dance in the Midland Hotel, New Street, Birmingham, on Saturday, February 2. Mr. W. A. S. Calder will preside, and distinguished guests have been invited. The dinner will be followed by dancing. Tickets can be obtained from Mr. G. King, 39 Upland Road, Selly Park.

THE SENATE OF THE LONDON UNIVERSITY on January 23 conferred the following titles in respect of posts held at schools of the University:—Professor: Chemistry, Dr. J. W. Cook, D.Sc., Ph.D., London (Cancer Hospital); Reader: Organic Chemistry, Dr. G. A. R. Kon, M.A., Cambridge, D.Sc., London (Imperial College, Royal College of Science).

THE IMPORT DUTIES ADVISORY COMMITTEE has received applications for an increase in the import duties on iron and steel (including alloy steel), blooms, billets, slabs and sheet and tinplate bars (other than of wrought iron produced by puddling with charcoal from pig iron smelted wholly with charcoal) and iron and steel rails weighing less than 36 lb. per yard.

Chemical Trade Inquiries

The following trade inquiries are abstracted from the "Board of Trade Journal." Names and addresses may be obtained from the Department of Overseas Trade (Development and Intelligence), 35 Old Queen Street, London, S.W.1 (quote reference number).

Trinidad.—A firm of manufacturers' agents in Port of Spain wish to obtain the representation of United Kingdom manufacturers of Portland cement, on a commission basis, for Trinidad. (Ref. No. 82.)

France.—An agent established at Paris wishes to obtain the representation, on a commission basis, of United Kingdom manufacturers of workshop machinery of all descriptions, chemical products and paints and varnishes. (Ref. No. 94.)

Poland.—A firm in Warsaw wish to represent United Kingdom manufacturers of colour and paint mills, copper and aluminium ingots. (Ref. No. 96.)

Sweden.—An agent established at Nordano wishes to obtain the representation, on a commission basis, of United Kingdom manufacturers of pigments, particularly zinc white and red lead. (Ref. No. 97.)

Egypt.—The Commercial Secretary to the Residency, Egypt, reports that the Egyptian Ministry of Finance is calling for tenders, to be presented in Egypt by February 19, 1935, for the supply of ferro-prussiate paper and linen and ferro-gallate paper and linen. (Ref. B.Y. 7961.)

Forthcoming Events

LONDON

Jan. 28.—Institution of Vitreous Enamellers (Southern Section). Some Aspects of Plant Lay-out and Production. J. T. Gray. 8 p.m. British Industries House, Marble Arch, London.

Jan. 30.—Electrodepositors' Technical Society. Fifth Annual Dinner. Comedy Restaurant, Panton Street, London.

Feb. 1.—Royal Institution. "The Approach to the Absolute Zero of Temperature." F. Simon. 9 p.m. 21 Albemarle Street, London, W.1.

Feb. 1.—Society of Dyers and Colourists (London Section). "Problems of the Dyeing Industry." L. P. Rendell. London.

BIRMINGHAM

Jan. 29.—Birmingham University Chemical Society. "Surface Reactions." Professor E. K. Rideal. 5 p.m. Chemical Lecture Theatre, Edgbaston, Birmingham.

Jan. 31.—Midland Metallurgical Societies. "Some Technical Aspects of the Manufacture of Steel Sheets." C. A. Edwards. 7 p.m. James Watt Memorial Institute, Great Charles Street, Birmingham.

Feb. 2.—Midland Chemists' Committee. Annual Dinner-Dance. 6.45 p.m. Midland Hotel, New Street, Birmingham.

BRISTOL

Jan. 29.—Institute of Chemistry (Bristol and South Western Counties Section). "The Activities of Life and the Laws of Thermodynamics." Professor F. G. Donnan.

GLASGOW

Feb. 1.—Society of Chemical Industry (Edinburgh and Glasgow Sections). Jubilee Memorial Lecture. "The Fats—New Lines in an Old Chapter of Organic Chemistry." 7.30 p.m. Royal Technical College, Glasgow.

MANCHESTER

Feb. 1.—Society of Chemical Industry (Liverpool Section). Joint meeting with the Manchester Section. Jubilee Memorial Lecture—"In Quest of Colour." C. J. T. Cronshaw. 6 p.m. 17 Albert Square, Manchester.

NEWCASTLE-ON-TYNE

Jan. 31.—Institute of Chemistry (Newcastle-on-Tyne Section). "Types of Chemical Linkage"—A Refresher Lecture. Dr. R. D. Haworth.

SHEFFIELD

Feb. 1.—The Chemical Society. "Some Recent Developments in the Study of Chemical Reaction Mechanism." C. N. Hinshelwood. 5.30 p.m. University, Sheffield.

SOUTH WALES

Jan. 31.—Society of Chemical Industry (South Wales Section). Visit to the dry coal-cleaning plant of Insole's, Porth. 2 p.m.

WORKINGTON

Feb. 1.—West Cumberland Society of Chemists and Engineers. "The Technique of Honey Production." A. C. Nelson. 7 p.m. Workington.

New Companies Registered

Biotox Manufacturing Co., Ltd.—Registered January 18. Nominal capital £500. Manufacturers of chemical compounds and preparations, etc. Subscribers: James J. Cassidy, 4 Cambridge Terrace, Leeson Park, Dublin; John C. Cassidy.

British Bitumen Refineries, Ltd.—Registered January 18. Nominal capital, £60,000. Buyers, sellers and refiners of and dealers in petroleum and other oils of every kind and all substances and materials whether gaseous, liquid or solid, from which bitumen or any product containing bitumen can be prepared, manufacturers of and dealers in bitumen, tar, emulsions of bitumen or tar, asphalt and spirits, etc. A subscriber: Arthur H. Palmer, 35 Downlands Road, Purley.

Henry E. Cox and Co., Ltd., High Street, Oldland Common, near Bristol.—Registered January 22. Nominal capital £20,000. Manufacturers of machinery for the paint, ink, chemical, food and allied trades, ironfounders, mechanical engineers, etc. Directors: Henry E. Cox, 131 City Road, Bristol, Edward C. Greenhill, Norman C. H. Bodman, Alexander J. Veale.

Fumigations (Cimex), Ltd., 68 Victoria Street, London.—Registered January 21. Nominal capital, £500. Manufacturers and factors of, agents for and dealers in chemicals, fumigants, compounds, materials, liquids, gases and substances for or incidental to the destruction of vermin, insects and pests and the adaptation and use of fumigating apparatus, etc. Directors: William B. Bentley, Frank J. Elvy, Wallace H. Elvy, Bertram W. Elvy, Donald H. Courtenay.

Terravit Chemical Co., Ltd.—Registered January 15. Nominal capital, £1,000. Chemical manufacturers, dealers in all kinds of chemicals, etc. A subscriber: David Carruthers, 34 Portland Street, Kilmarnock.

Kaye Chemicals, Ltd.—Registered January 22. Nominal capital £2,000. To acquire any invention or recipes relating to processes of manufacturing and the rights to manufacture and deal in any medicinal preparations and prescriptions, medical and surgical goods, instruments and appliances, manufacturers and sellers of medicines and preparations, chemicals, etc. A subscriber: Fredk. G. Watts, 9 Carlos Place, London.

Shallcross Bros. and Co., Ltd.—Registered January 12. Nominal capital, £1,000. Manufacturers of, dealers in and agents for all kinds of chemicals and chemical compounds, including soaps, mordants, sizes, bleaching compounds, etc. Directors: Arthur Shallcross, senr., 25 Brownsville Road, Heaton Moor, Stockport; Arthur Shallcross, jnr.

Walker Solutions, Ltd., Pyrosol Works, Walnut Tree Road, Brentford.—Registered January 9. Nominal capital £2,400. Inventors and manufacturers of and dealers in preparations or solutions for rendering materials or substances of whatsoever kind, whether solid, liquid, or otherwise, fire or heatproof or resisting, etc. Director: Edward J. Walker.

Yorkshire Wool Fat and Grease Co., Ltd.—Registered January 9. Nominal capital, £100. Manufacturers' agents and representatives, dealers in all kinds of grease, fats, fatty matter, oils, lubricants, spirits, and fine or heavy or other classes of chemicals, etc. Directors: John N. Barnes, The Old Vicarage, Rawcliffe, near Goole, Sydney J. Munden.

Company News

Bituminous Compositions.—The net profits, apart from special losses shown in profit and loss account, amounted to £273, compared with a loss of £3,101 for the previous year

South Metropolitan Gas Co.—A final ordinary dividend of 3½ per cent. has been declared, making 5¾ per cent. for 1934, against 6 per cent. for the previous year.

Herbert Morris.—The company announces the payment of half-year's dividend to January 31, 1935, on 5 per cent., free of tax up to 6s. in £, cumulative preference shares.

Metafilters (1929).—A statement has been issued showing the position at the date of application for release: net realisations, £1,326; total costs and charges, £349; creditors, preferential, paid by receiver, 97 unsecured, dividend of 1s. 4 7/10d. on £14,020—£975; expected to rank, £14,768. The receiver appointed on behalf of debenture-holders secured for assets a net amount of £2,814, after paying costs of action, etc.; security contained in debentures was invalidated, except to the extent of £1,629 (including interest and tax).

New Chemical Trade Marks

Compiled from official sources by Gee and Co., patent and trade mark agents, Staple House, 51 and 52 Chancery Lane, London, W.C.2.

Opposition to the registration of the following trade marks can be lodged up to February 2, 1935.

Cybate. 554,947. Class 2. Chemical substances used for agricultural, horticultural, veterinary and sanitary purposes. Imperial Chemical Industries, Ltd., Imperial Chemical House, Millbank, London, S.W.1. October 22, 1934.

Sanizal. 555,821. Class 2. Chemical substances used for agricultural, horticultural, veterinary and sanitary purposes. Newton, Chambers & Co., Ltd., Thorncliffe Iron-works and Collieries, near Sheffield. November 22, 1934.

Hibitite. 554,961. Class 1. Chemical substances for use in metal pickling. Monsanto Chemicals, Ltd., Victoria Station House, Victoria Street, London, S.W.1. October 23, 1934.

Calgon. 555,156. Class 1. Water softening preparations. Keith Piercy, Ltd., 39 Eccleston Square, London, S.W.1. October 29, 1934.

Richdec. 556,098. Class 1. Paints, enamels (in the nature of paints) and varnishes. Cellon, Ltd., Cellon Works, Richmond Road, Kingston-on-Thames, Surrey. December 3, 1934

Opposition to the registration of the following trade marks can be lodged up to February 16, 1935.

Muscosyn. 556,165. Class 1. Chemical substances used in manufactures, photography, or philosophical research, and anti-corrosives. Schering-Karlbaum, Akt.-Ges., Mullerstrasse 170-172 Berlin, N. 65, Germany. December 5, 1934. Address for Service in the United Kingdom is c/o Carpmaels & Ransford, 24 Southampton Buildings, Chancery Lane, London, W.C.2.

Kavit. 556,441. Class 1. Chemical substances for steeping colouring and brightening textile fabrics and leather in the course of manufacture. H. Th. Bohme Akt.-Ges., 29 Moritzstrasse, Chemnitz, Saxony, Germany. December 15, 1934. Address for Service in the United Kingdom is, c/o H. Douglas Elkington, 20 to 23 Holborn, London, E.C.1.